

Ontario Department of Agriculture

FRUIT BRANCH

PEACH GROWING

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It is not my intention to attempt to write a long treatise on the peach, or discuss it from every point of view, but rather to put into readable form a few facts gained from experience and observation, in survey work in the Niagara Peninsula, together with the results of some experimental work in the different States of the Union. The study of the industry in relation to tariffs is the work of the trained economist and the leaders in the industry and will not be dwelt on here. The methods of production, planting, pruning, cultivating, fertilizing, thinning, picking, packing, marketing, etc., are more practical, and must be understood by all growers if good results are to be expected by them. As the supply or production increases, the quality of the fruit must advance if the present good prices are to be sustained. It is for this man, the man who is aiming at quality, that this treatise is written.

We believe that in a few years—perhaps not more than four or five—second and third class peaches will be a drug on the market; but good fruit must always sell at a profit. Growers, as a whole, are learning this very quickly, and as knowledge of the work becomes more general and growers become more expert, the man who refuses to keep up to the times must of necessity be forced out of business; quality must be the first consideration.

CLASSIFICATION.—The peach, in early botanical classification, was known as *Amygdalus Persica*, also as *Persica vulgaris*, but now it is classified with the other stone fruits and known as *Prunus Persica*.

There are five distinct races of peaches in America to-day, known as the Persian, the Chinese Cling, the Southern Chinese, the Spanish, and the Peen To. But we in Ontario are concerned only with the two hardier races, the Persian, to which belong such varieties as Comixen, Crawford and Salway, and the Chinese Cling, to which belong such varieties as Carman, Elberta, Greensboro' and Smock. These are well adapted to our northern climate. The other groups are all of a tropical nature.

HISTORY.—The first peaches are supposed to have been brought to America by the early settlers near the end of the seventeenth century, either as small trees or as pits. The pits reproduced true to type, and seemed to be adapted to a wide section of country. They were planted in garden and field, mostly at random, and to-day are found growing wild in the mountains of Virginia, the mother State of peach culture. It is from the crossing of these two groups, Chinese Cling and Persian, under varying conditions, that the most of our present varieties are derived. The first record we have of peaches grown for market in Ontario is from Mr. Dennis Woolverton, of Grimsby, who sold natural fruit in Hamilton market as early as 1820. In 1856, Mr. C. E. Woolverton, of Grimsby, planted five acres of commercial orchard, of such varieties as Barnard, Crawford, Oldmixon and Mountain Rose, and was, we understand, the first to ship by express to distant Ontario markets. From 1890 to 1898 the industry was boomed excessively and fell. Everybody got the "get-rich-quick" idea and planted peaches. Very few knew how to produce good quality, with the result that large quantities of a low grade product were thrown on the market, which often did not pay the express charges. A severe winter freezing in 1897-98, coupled with the low prices, tended to check production and force out of business a large number of growers. The check was indeed severe, but it was not without its good results. The best of the growers came back slowly with improved methods and a better quality of fruit, until about 1904 and 1905 the supply again began to equal the home demand. This led to better methods of shipment and sale. The year 1904 saw the first shipment of peaches to the West by freight. Co-operative associations, especially the St. Catharines Cold Storage and Forwarding Co., and a number of independent buyers, began a systematic distribution which has greatly increased each year. The buyer deserves a great deal of credit for the market extension. He took the risk and shipped to distant points in quantity fruits that the individual grower must have otherwise cast on the nearby commission market.

The above applies to the Niagara district only. Lambton, Norfolk, and other counties have their history to make. The industry there is still in its infancy, centred around a few good men who are proving that peach culture is a profitable business, and sending the news broadcast to all who have "eyes to see and ears to hear." Watch the above counties grow; climate, markets and general conditions favor them a great deal.

Essex has grown peaches perhaps as long as the Niagara Peninsula, and is second in importance to-day. Repeated freezings have done much injury there, but as improved methods have become more generally understood the industry has become more firmly established, and it is believed that, now, the growers are in a much better position to fight the extremes of winter than formerly. The plantings are increasing very rapidly, and the quality of fruit that reaches the market is equal to the best in Ontario. As in the Niagara Peninsula the plantings during the last few years have increased extensively.

EXTENT OF INDUSTRY.—As previously stated, the commercial peach areas of Ontario are comparatively small, except in Lincoln and Lambton, and the counties on Lake Erie. Throughout the Province trees may be found growing in the home garden, but these are not factors commercially. A careful study of the map of Ontario will show that in every case the area where extensive culture is practised is under the influence of a large body of water. In every case the slope is northern, or is so situated that there is a free circulation of air. In Lambton and Lincoln the north wind of winter must of necessity sweep for miles across the comparatively warm waters of the lakes before coming in contact with the buds. It is the regulating of the climate by these waters that makes tender fruit production possible at all. Essex and Elgin and Norfolk are tempered by elevation and by the waters of Lake Erie.

Ontario has within its area 90 per cent. of the peach trees grown in Canada, the 1911 census crediting this Province with 1,681,853 out of a total of 1,884,459 trees. The increase is given as 31.1 per cent, over the census of 1901. Of this number, approximately 95 per cent. are grown in the Niagara peninsula, largely in the townships of Niagara, Grantham, Louth, Clinton, Grimsby, Saltfleet and Barton, along Lake Ontario, and also in Stamford, Thorold and Pelham, in Welland County. The latter three townships are above the escarpment, and contain several square miles of excellent peach soil, but at present only a very limited area is planted.

Lambton County has approximately one hundred and seventy-five acres, or 18,000 trees, with about 50,000 trees ordered for planting in the spring. A large tract of land on the shore of Lake Huron, near Forest, much resembling the land on Lake Ontario in the Niagara district, gives promise of excellent results.

The acreage in Norfolk County is still less than that of Lambton, but the trees now growing are healthy and vigorous. The soil is, in many parts, excellently adapted to peaches, and some large orchards are being planted.

The Leamington district has several hundred acres of trees, the majority of which are well cared for and should prove a very important factor commercially in the next few years.

Some trees are grown along the shores of Lake Erie in Kent and Elgin Counties, but the plantings are limited as yet. The possibilities of these districts are, however, greater than is generally supposed.

NURSERY STOCK.—The seedling trees are grown from the pits of the ripened fruits. It is not long since it was thought that pits from the natural fruit found growing in the Southern States were hardier and produced a stronger root system than the pits of cultivated varieties, but now the practice is, to some extent, discontinued, and the pits of our ordinary varieties are used. The pits are collected in the fall and stored in a cool, moist place, or buried in a broad, shallow hole, two or three inches deep. They must not be allowed to become dry. When thus stored the frost cracks a number of them, and in the spring the rest are cracked

carefully so as not to injure the kernel, and at once planted in the field where it is intended the young seedlings shall grow. Care must be taken not to plant too deeply, from one to two inches of covering being sufficient. The rows should be left three and one-half feet apart, with at least eight inches between the pits in the row. Crowding tends to weaken the trees. The soil must be in good condition, both chemically and physically.

By August of the same year the seedlings are ready to bud. The buds are taken from a bearing tree or nursery row of known variety, and placed just under the bark of the seedling about four inches from the ground, and held in position by winding with raffia, the inner bark of the palm tree, in such a manner that it covers the wound but not the inserted bud. This is the ordinary budding operation. As soon as the buds take, or in the following spring, the seedling top is removed, and the new bud given every chance to develop. By the following fall it has grown into a fair sized tree, such as is usually obtained from the nursery. Thus in our climate two years are required to produce a tree from the pit. In the South, where the seasons are much longer, the seedlings are budded in June of the same year the pits are planted, and by fall have attained a size suitable for transplanting. The trees are dug in the fall, and are stored in cellars or storing sheds with the roots in moist sand or moss. This is done to facilitate packing for early shipment in the spring.

The trees are now ready for the grower, and it is here that his interest starts. But it should have started when the trees were seedlings in the nursery row. The budding operation, or rather the choice of bud inserted, should have excited his keenest interest. The cutting of buds from the nursery row or from non-bearing trees, is a practice that cannot be too strongly condemned. There are always many healthy bearing trees in the vicinity of the nursery of the required variety from which it is possible to obtain buds. These trees should be made use of, as it makes mistakes less liable and insures the growth of a tree that has not lost the "habit" of bearing. This applies more largely to apples than to peaches. Budding directly from the nursery row, where Yellows and Little Peach when present are not yet sufficiently developed to detect, is a means of spreading disease that is usually overlooked. Nevertheless, the spread of disease from this source—that is, from diseased nursery stock—is quite common; so common, indeed, that it is calling for special legislation in Virginia and possibly some other States. The Report of the State Entomologist, Virginia, 1908-1909, gives conclusive evidence of the spread of disease through nursery stock.

The practice of budding from the nursery row, besides spreading latent disease, gives no chance for selection. It is a well-known fact that no two trees yield the same average quantity of fruit, even under the same conditions. Some bear very heavy loads every year and some do not bear at all. Which are we going to propagate from, and how are we going to distinguish them until they have proved their usefulness by hard work? For this reason, it is recommended that one man grow the

nursery stock for a group of men, each of whom might furnish buds for the new trees that had proved their value on his own farm.

SOILS.—Taking it for granted that the prospective grower is in a district adapted to peach culture, the first point that naturally arises is the choice of soil on which to plant. This is very difficult to answer unless all the conditions are known. There are many orchards on very light sand, giving excellent returns. Also there are some on clay soil doing equally well, which means that to a large extent the grower has matters much under his own control. But the natural soil of the peach is a deep rich gravelly loam or sand loam with the water table at least three feet below the surface. This is important. Surplus water means death to the roots. There is still much natural land available, and on this production is cheapest. Clay soil is not natural peach soil, but may be made so by the addition of humus, thorough cultivation, and under-drainage. Underdrainage, unless the natural drainage facilities are excellent, should come first. Trees on a deep moist—not wet—soil send a tap root as much as three or four feet into the soil and hold firmly, while those on a soil with an impervious or wet sub-soil, send their roots out laterally or horizontally, and are often much affected by the wind. It is common practice in these cases to ridge the trees very highly, so that all water or surplus moisture will find its way to the furrows between the rows. These soils are more adapted to grapes. Peaches on them are an expensive production.

SITE.—The choice of site is as important as choice of soil. It is not expected that every field on the farm is equally well situated, and even though they may all be very good, one must, in some respects, be better than the rest. The investment is of long duration, and when once the work is started a mistake is very hard to rectify. It is well, then, to take special care. Consult your neighbor and find out what the best men of the immediate neighborhood are doing. They can give the best advice for your special conditions. But though location may modify conditions, the principles remain the same.

(1) Use a northern slope, or at least a spot where there is a free circulation of air on the coldest nights. Avoid hollows: frost or cold air settles in them. A southern slope, almost without exception, should be last choice. This is warmest during the bright days of winter and early spring, and is sure to start the buds quicker than the colder northern slope. Wind, on nights we have frost, usually comes from the north. However slight the movement the north slope gets it, while on the south slope the air is perfectly still, and frost is sure to settle there.

(2) Use the driest soil that will retain moisture. A peach tree must have a large quantity of water, but at the same time there must be no surplus moisture. The tree is very susceptible to it. Keep it dry. Drain the soil.

(3) Give sand or sand loam the preference. At the same time, do not forget the sub-soil. It is just as important as the surface soil, and must

be of a loose, porous texture. Sand is much more easily cultivated than clay, and though it may require a little more fertilizing than clay, the same quantity of humus that will put the clay in first-class condition will make sand first-class also.

(4) Do not plant on a wind-swept hill simply to get air drainage or air circulation, and at the same time do not plant too near a high wind-break. There must be air, but it must not be excessive, or almost entirely shut out. Use common sense.

PREPARING THE FIELD FOR PLANTING.—The best way to handle a field before planting admits of a great deal of discussion, and many methods are practised. But in a large majority of cases no regular plan is followed



The first year of the Peach Orchard, showing good growth from the whip.

at all. The trees are simply set when the grower gets the inspiration, regardless of what grew on the field the previous year. But this practice is not to be encouraged.

Occasionally the trees are planted in sod, but poor growth and a large percentage of loss is usually the result. Even when sod is fall plowed and well worked down the following spring, the trees do not make the best growth. The practice of planting in a sod and then plowing up to the trees should not be encouraged. The soil requires as careful preparation for this crop as for any other. If early returns are to be looked for, preparation must begin at least one year before planting; longer preparation is better, but this depends much on the methods of cultivation to

be followed later. The principle requisite is that the soil be rich and mellow when the trees are set. The trees have to form new root systems and become established. They must be nursed: so do not plant them in sod. It pays to wait a year and get the ground as loose and mellow as possible.

No method could be outlined that would suit the conditions of all, but below are given two extreme methods that have given good results. Each is represented by a good orchard in the Niagara Peninsula.



An 18-acre Peach Orchard of the Niagara District. Trees 2 years planted.

(1) A sand soil in fair condition was sowed to oats and seeded down with clover. The oats were harvested, and the following spring the trees were set. As soon as the clover had made a fair growth it was plowed up to the trees. The soil was cultivated again thoroughly till early fall, when rye was sown. The following spring this was plowed under as soon as it was from twenty to thirty inches high. Again the orchard was well cultivated all summer, and in the early fall seeded to vetch and plowed under the following spring. Besides this the orchard received on an average about two hundred and fifty pounds of bone meal and potash each year per acre in the ratio of two of the former to one of the latter. No crop has yet been taken from the field, therefore results cannot be given, but the trees are equal to the best.

(2) The soil was in excellent condition, both chemically and physically, rich, mellow, and full of life. The trees were carefully set and crops of vegetables, etc., grown for the first two years. Heavy applications of manure were applied each year for the intercrops to feed on. During the third and fourth years, heavy leguminous cover crops were grown and

returned to the soil. The grower hopes in this way to add such a quantity of humus and vegetable matter that it will not be necessary to apply barnyard manure or another cover crop for some years. Commercial fertilizers are to be added each year when the orchard begins to bear.

It will be noticed that in the first case the soil was poor when the trees were planted and the whole object of the owner was to build it up and get as much growth in the trees as possible before they began to bear. In the second case the soil was already highly fertile, and the owner grew an intercrop for two years, but took nothing from the soil that he did not replace. The next two years were intended to force growth on the trees, and fill the soil with humus before heavy crops of fruit were to be expected.

One orchard is as good as the other, and the principles involved will apply to almost any conditions. The above two methods differ from general practice only in that the grower fed the trees to get returns instead of waiting for the trees to produce a crop with which to buy manure to feed them to produce a second crop.

VARIETIES.—This selection of varieties is as important as the selection of the site. A few known varieties have established themselves in almost every district, and it is much better to follow the advice of the grower who has proved them, than the advice of the nursery agent. A few trees of the newer varieties may be worth trying experimentally, but it is not good practice to plant a large number of them until certain of their value.

How many different varieties to plant must, of course, depend on the size of the plantation, the market catered to, the ambitions of the grower, and the conditions under which he is working.

Labor in the picking season is an important factor. A grower has often to depend on his own family, and in that case it is well to extend the ripening season over as long a period as possible. Or he may be growing for the factory, and wish to dispose of the crop before the apples are ready, when fewer varieties would be better. All varieties are not good canners. Or he may be catering to a special fancy trade, when the mid-season varieties would be best. But whatever the factors influencing the choice, *quality* should be the first consideration. There are plenty to choose from—sixty or more under cultivation in the Niagara Peninsula to-day—besides new ones coming in and poor ones being discarded yearly.

The following are recommended for the commercial plantation, for Canadian markets, covering the entire season. There may be some varieties equally as good, but the following ones have held their place and proven their value. They are given in the order of ripening, and though each is recommended it does not follow that they should be given an equal place in the plantation. Some are better than others.

- (1) *Alexander*, first peach of any importance to reach the market; ripens in early August; poor quality, cling pit and inclined to be wormy; its only value is in its earliness; comes into competition with Southern fruit.

- (2) *Triumph*, ripens about mid-August, largely planted, but not exceedingly popular on the market on account of its downy skin, dull color, and susceptibility to rot, has a small place following the Alexander, but is no advertisement of what is to follow.
- (3) *Yellow St. John* is the first good yellow-fleshed peach to reach the market. Ripens from middle till last of August, good color, good quality, heavy bearer, good shipper; is one that everybody grows.
- (4) *Early Crawford*, ripens in early September, good quality, good color, good shipper, and well known to the trade; many other varieties of the same type are sold under this name.
- (5) *Garfield* or *Brigdon*, ripens the first of September, good peach of Crawford type, medium size, excellent color, good shipper; fills the space between St. John and Crawford.
- (6) *Reeves Favorite*, ripens with New Prolific; good size and color, good shipper; is a favorite with a large number of growers.
- (7) *Niagara*, ripens same time as Chair's Choice; inclined to bunch, good quality, good shipper, very large size, well recommended.
- (8) *New Prolific*, ripens from mid to late September; very heavy bearer, medium size, good quality, good shipper, responds to manure, cultivation and thinning. This latter quality caused a prominent grower to remark: "If I could grow but one variety, it would be New Prolific."
- (9) *Elberta*, ripens about ten days or two weeks after Early Crawford; large size, fair quality, best shipper; best commercial peach and more largely grown than any other variety.
- (10) *Crosby*, medium sized, rich yellow-fleshed peach; a good canner and one of the best quality peaches grown.
- (11) *Chair's Choice*, good peach, good quality, good shipper; is well recommended and planted very largely.
- (12) *Smock*, best late peach we have; fair color, fair quality, excellent canner, ships well to distant markets.

Any five of the above varieties would make a good combination for the commercial orchard.

To show the difference of opinion regarding the varieties, the choices of five prominent growers are here quoted.

- I. Triumph, St. John, Crawford (type), Elberta, Crosby, Chair's Choice, Niagara and Smock.
- II. Triumph, St. John, Crawford, Fitzgerald, Elberta, Niagara.
- III. St. John, Fitzgerald, Reeves Favorite, Jacques Rareripe, Elberta and Oceana.
- IV. St. John, Fitzgerald, Crawford, Reeves Favorite, New Prolific, Elberta.
- V. St. John, New Prolific, Elberta and Niagara.

It will be noticed that St. John and Elberta appear in every list.

The smaller varieties are gradually being discarded; size and color bring the price.

The four following are preferred by the factories for canning purposes: Hill's Chili, Elberta, Crosby and Smock.

Hill's Chili, not described above, is a medium-sized, firm peach of good quality, medium bearer, ripening just before Elberta.

It will also be noticed from the above lists that, excepting the early varieties, not a single white-fleshed fruit or cling-stone is recommended. This is not surprising, as far as cling-stones alone are concerned, but when we consider that some white-fleshed peaches are large and of excellent quality we have cause to wonder. But the Canadian market does not demand and will not pay as high a price for a white-fleshed peach as for a yellow. The English market likes the white flesh, and in the future there may be a large demand; but at present the planting of them is not recommended. Oldmixon, Mountain Rose, and Carman are our best white-fleshed varieties.

When making a selection of varieties, it is well to aim at prolificness, size, color and shipping quality, combined with texture and flavor. But it is size and color that bring the price under our present system of marketing, and no matter what the quality and flavor, unless it has these two qualities, it will be lost in the keen competition.

Are some varieties over-planted? It cannot be said that they are, unless it is such varieties as Greensboro, Rivers, Alexander, Smock, etc., which are lacking in size, color and quality. Elberta, St. John, New Prolific and Smock are perhaps planted heaviest, in the order named, but as yet no one has failed to get a fair price for good fruit of these varieties. Smocks would be over-planted if it was not for the fact that the factories take a large percentage of the production.

SELECTION OF STOCK, TIME TO PLANT, ETC.—Because of a large demand for young stock, a large number of inferior trees, so-called, have been put out by the nurserymen in the last few years. The greatest demand is for the larger trees—four to six feet high. Trees with straight trunks, three or four feet high, are next in demand. These latter really have a decided advantage over the former because of less loss in transplanting, and because the grower can head as low as he chooses and expect to get fair results. The smaller and tenderer the bark is, the more likely are the chances of a well-distributed growth on the trunk. I do not mean to advocate the planting of second-class trees, but rather first-class trees of medium size, with good root systems. These can be headed as low as twenty inches or less. They should be one year old from the bud.

Instead of cutting back to a whip, if there are any side branches it may be advisable to prune them back to two or three buds and leave them for the framework of the tree. This is only good practice, however, when they are properly spaced, four to six inches apart, and arranged around the trunk. At least three branches should be saved; four is better.

It may sometimes be advisable to use both methods—cutting back to whips and leaving side branches—in the same row. Good judgment must be used and the choice made after the tree is set.

Spring planting is advised, as a tree not well rooted may dry out and die during the winter. But fall planting is being practised more and more every year, and where labor is scarce and time pressing in the spring it may be well to plant in the fall and risk loss by winter drying and freezing.

DISTANCE TO PLANT.—The distance apart to plant depends a great deal on the system of pruning to be followed later. Where severe heading-in is practised, 16 feet by 16 feet is a good distance, but that is the extreme advised. The greatest distance practised is 20 feet by 20 feet, but the orchards set at this distance are very limited; 20 feet by 20 feet is the best distance for the average grower, and is being gradually adopted, especially in the larger plantations; 18 feet by 18 feet is the distance most in favor in the townships of Louth, Clinton, Grantham and Niagara. Eighty-four orchards out of two hundred and forty-three visited in 1910 are planted this distance. In Saltfleet, Barton and North Grimsby, 16 feet by 16 feet is the favorite distance, 18.6 per cent. being planted this distance. Sixteen per cent of the orchards are planted 15 feet by 15 feet, but apparently are much too close. In Niagara Township, where land is cheaper than farther west, 20 feet by 20 feet is the favorite distance. The rule that on dearer land the trees are planted closer seems to hold good, but it is very doubtful if this is a profitable method of intensive culture.

Following are the distances apart the trees were planted in the orchards surveyed:—

18 x 18	129 orchards	20 x 20	57 orchards
16 x 16	111 "	16 x 18	45 "
15 x 15	89 "	16 x 20	19 "
18 x 20	62 "	Other distances	137 "

Besides the square and rectangular systems of planting, the diagonal and hexagonal systems are sometimes used. Neither is recommended for peaches, as the tendency is to plant too many trees to the acre, even on the square system. The diagonal and hexagonal systems allow a greater number of trees to the acre.

PRUNING.—The following observations regarding pruning should be carefully considered:—

(1) *The Principles.* The subject of pruning is one of wide discussion, and it is doubtful if any two agree exactly in their methods of operation. Simply cutting pieces from the root or limbs is not pruning. There are certain principles to be followed, and no matter how varied the methods these remain the same.

1. The habit of growth varies with the different fruits.
2. One branch lives at the expense of another.
3. Heavy winter pruning induces wood growth.

4. Plants grow from uppermost or outermost buds.
5. Cutting off terminal buds develops the lateral buds.
6. Pruning thins the fruit.
7. Heading-in in summer and checking wood growth induces fruitfulness.
8. Pruning depends on climate, moisture and general conditions.



Three-year planted Peach Tree unpruned.

(2) *Root-pruning.* How severe to cut back a root before planting admits of discussion, but it is agreed that all dead, injured or broken pieces should be removed so that a callous will have a chance to form on an even, healthy surface. Both methods, cutting back to a stub and leav-

ing all the roots, have their advocates, but the following experiment, taken from Delaware Bulletin XLV., would indicate that an intermediate method is better.

Fifty-four Crawford trees were used in each experiment, that is, three eighteens, and the roots were cut back to eight inches, three inches, and stubs or all roots removed.

In clay, cut to 8 inches, 17 lived, 17 were first class.
 In clay, cut to 3 inches, 18 lived, 18 were first class.
 In clay, cut to stubs, 10 lived, none were first class.
 In sand, cut to 8 inches, 18 lived, 18 were first class.
 In sand, cut to 3 inches, 18 lived, 17 were first class.
 In sand, cut to stubs, 17 lived, 2 were first class.



Same tree pruned for high quality fruit.

The experiment was conducted with apples, pears and plums also. The following results were obtained:—

8-inch pruned, 91.0 per cent. lived, 91.0 per cent. first class.
 3-inch pruned, 98.5 per cent. lived, 93.7 per cent. first class.
 Stub pruned, 72.5 per cent. lived, 36.5 per cent. first class.

These results would indicate that it pays to cut back the roots to from three to eight inches.

HEADING.—Ten years ago, low-headed trees were very rare, but to-day, perhaps, one-half being planted are as low as twenty-four inches. The idea is gradually spreading, and now it is very seldom that we see a young orchard headed from three to four feet high. The idea in a low-headed tree is to get the fruit as near to the ground as possible, so that it can all be picked from the ground or, at most, from a two- or three-foot ladder.

FIRST PRUNING.—Do not start to prune unless you have a purpose in view. At the end of the first season, the trees should have made considerable growth. New Jersey Bulletin 219 puts it at from two hundred and seventy-five to three hundred inches linear growth on an average per tree. It may be necessary to prune away one-half or two-thirds of this, but the object is to form the framework of the tree and any unnecessary branch should be sacrificed to this end. Three or four branches well placed are much better than five or six poorly placed. The severe pruning will stimulate growth and give a large number of branches to choose from the following year. It will not increase the size of the trunk, but rather increase the number of laterals.

SECOND PRUNING.—The pruning at this time should be much the same as that of the previous year. The framework of the tree is started and it is simply necessary to thin out the new wood. Keep out the central limbs, as they develop at the expense of the laterals and tend to make the tree too upright. Heading-in a limb just above a bud on the outside tends to force outward growth and to widen the tree. Keeping the centre open encourages new growth from the centre. It is the wood produced this season that must produce the fruit the following year, that is the fruit when the tree is three years of age.

THIRD PRUNING.—Up to this time we have been pruning for wood growth and to direct the formation of the tree. Now it is time for the tree to produce. To thin out too severely or cut back very heavily may mean the loss of a large number of fruit buds. It is well then to wait till late spring, when the crop prospects are fairly definite before beginning pruning. A tree three years old should bear from one to two baskets; sometimes they bear much more, but usually a great deal less. And this quantity is given only as a guide to indicate what is possible at that age. The thinning out of the very thick part of the tree and the removal of such branches as are drooping or are likely to be injured during cultivation may take place at any time. Whether to head-in or not is at the discretion of the grower. Too severe cutting back, one-half or two-thirds, is not recommended. Thinning out and cutting back about one-third would be much better. No one can tell how to prune. We must have the tree before us and do the work ourselves. Very severe cutting back or heading-in, in the colder districts is not practised because of the small tender growth thus produced.

WINTER PRUNING.—The general practice up to three years of age is to prune as previously indicated, but still there are some excellent growers who, up to that age, do not prune at all. They claim that just as strong growth can be obtained and that the trees fruit much better. And results do not prove that their contentions are wrong. But the great objection is that when the tree is allowed to grow at random so long it is very difficult to form a regular well-balanced head. No evil will result from directing the growth from the start.

Thinning out a little and cutting back the ends of the branches each year tends to keep all the bearing wood on the ends of the limbs and high up in the air. A good plan is to keep the centre open so that new growth is always coming on, which will take the place of the old wood when its day of usefulness is past or when the bearing wood has grown out of reach. Renew the tree gradually. Cutting down into the old wood to stimulate new growth is often very advisable. A tree cannot be kept low simply by cutting off the ends of the branches. The pruning must be from the bottom up. The amount of wood to leave in a tree varies a great deal, but it is always well to leave it sufficiently open to allow of a free circulation of air. The leaves are the food manufacturers and they must have sunlight in order to do their work. Leave the tree so that the sun can shine on each leaf at some time during the day.

SUMMER PRUNING.—Summer pruning is practised systematically very little as yet. A number are experimenting, and the idea is spreading; but we have no definite results. Cutting and levelling the tops of the trees simply for appearance is not pruning.

The time to cut back is just when wood growth has almost or entirely ceased. The idea is to remove the terminal growing point and buds so as to throw the strength being used by it into the fruit buds. It may be cut back only an inch or two, or it may be as much as one-third of the total growth. A good example of how summer pruning acts is in the pinching out of the terminal growth of a rank-growing tomato plant in a greenhouse. It will cause the ripening fruit to burst. Similarly, the fruit buds are stimulated by the increased food supply. Care must be taken not to cut too early, or before the growth has almost ceased, because in that case small, weak growth will be forced out from the terminal and lateral buds and the strength of the tree will go into them rather than into the fruit buds.

INTERCROPPING.—Many growers cannot afford to wait three or four years for the first returns from their land. Limited capital forces the growing of intercrops. The growing of such crops is not advised, but still, if the soil is properly cultivated and fertilized, no great evil can result. But it must not be continued when once the trees begin to bear. Potatoes, tomatoes, corn or any other hoe crop between the rows are recommended for the first and second year. Strawberries, set the year the trees are planted, may be used. Currants, raspberries, gooseberries, etc., are sometimes used, but then the tendency is to favor the bearing intercrop rather than the trees. They do not come into bearing sufficiently early to be recommended. The practice of growing another crop

between the rows of bearing trees cannot be too strongly condemned. It is practised quite largely, but it is very difficult to see where there is any real gain.

CULTIVATION.—The cultivation of the orchard is a subject much discussed and opinions must always differ. But in every case the principles must be the same. Under the head of cultivation, fertilizing and cover crops might rightly be discussed also. The one operation overlaps the other.

When shall I plow my orchard, how often and how deep? is often asked. The soil itself, kind and condition, and your ideal of culture, must be the answer to the question. Some soils, especially the clays and clay loams, must be plowed to get a mellow surface. If a cover crop is sown and allowed to grow to a fair height, a plow must be used to turn it under. If the soil is a sand or sandy loam, and no cover crop is used, it is not necessary to plow, though some advocate it strongly. To twenty who are getting good returns, who plow in both spring and fall, fifteen plow in the spring only and seven in the fall only, while three do not plow at all and ten have no regular time. The three who do not plow do not leave their orchards because of carelessness, but because they feel that the same amount of work can be done cheaper with the disc and harrows and just as good or better results obtained. Ridging up for winter can begin in early summer and continue till it is time for cultivation to cease. An out-throw disc used with discretion will do this quite nicely. Many are doing it. Where the orchard is not ridged up in this way, it is necessary to fall plow, especially when there is a lack of underdrainage. The furrows between the rows will then carry off the surplus water. Also, it is preferred to have the orchard go into winter with the soil as firm as possible. A few weeds standing can do no further damage but really hold the leaves and snow.

Too early spring plowing is not recommended either. Allow the weeds to start. They will draw some surplus water from the soil and it will warm up quicker. The theory that plowing when the trees are in blossom causes the blossoms or young fruit to fall is not well founded if the work is carefully done. True, a great many plow just after the fruit is set, but that is because the soil happens to be in a fit condition just at that time. Also, by this time, if a cover crop has been used, it will have reached a fair height and will add considerable humus to the soil. From now till about the first or middle of July cultivation must be continuous. Harrowing once or twice a week is not too frequent; twice is better than once. This is the critical time for the tree. The young fruit is growing and the fruit buds are forming in embryo. Some continue the cultivation up till picking time or until the bending of the tree with fruit prevents; but this late cultivation is wasted unless the season is very dry, and besides there is danger of sending the wood and buds into winter in an immature condition. A shock to the tree, such as limiting the food supply or cutting down the moisture, will cause a storing-up

of food in the tree and a development of the fruit buds. This is best obtained by the use of a cover crop or by ceasing cultivation and allowing the weeds to grow; a cover crop, not weeds, is recommended.

In the counties bordering on Lake Erie it is recommended that cultivation cease and the cover crop be sown by the first of July, as there is more danger here from winter injury than in Niagara and Lambton.

The depth of plowing and cultivation varies, but in no case is more than five inches recommended; four is better. The extension disc is the best implement for the low-headed trees, but at the same time extension harrows play an important part; a spring tooth is often of more value than a disc.

MANURES. (1) *Manure and Cover Crops.* Cultivation is the cheapest and most valuable fertilizer at the disposal of the fruit grower. Orchards on sandy loam soil have been known to produce good crops for six or seven years in succession without farmyard manure or commercial fertilizer, but they have always had a good supply of humus and thorough cultivation. The best cover crops are largely the same composition as farmyard manure, and with the exception of being unable to seed the soil with the organisms of decay, can take their place in every particular. The following is the chemical analysis of the three most prominent cover crops compared to farmyard manure. The figures show the percentage:

	Nitrogen.	Phosphorus.	Potash.	Water.
Vetch	.65	.146	.475	79.15
Red Clover	.41	.13	.45	80.
Rye (green)	.33	1.5	7.5	
Manure	.5 to .75	.5 to .75	.25 to .375	

Vetch and Red Clover are legumes, and consequently take a large supply of their nitrogen from the air, and when they decay give it to the soil. Rye is not a legume, but has the power of breaking up, absorbing and making available a large quantity of potash. It supplies a large quantity of the much needed humus. Rye when left too long before plowing becomes tough and fibrous, and does not decay readily, but if handled at the proper time is in no way objectionable.

As the table shows, any one of the three crops mentioned gives, when plowed under green, almost as much plant food ton for ton as the manure.

(2) *Commercial fertilizers.* Commercial fertilizers, without humus, have no place in orchard management, and therefore must be used in conjunction with a cover crop or farmyard manure. True, nitrate of soda is readily absorbed without humus, but it is the only fertilizer in common use that is absorbed by the plant in the state applied. The others, through the action of humus, must first undergo chemical change.

Potash is applied either as the muriate or sulphate, the former being in most general use, though the latter is equally available. Phosphorus is applied in a number of forms, such as kainite, ground bone, Carolina rock, superphosphate, etc. The ground bone and superphosphate are best known. For quick returns, use the very finely ground bone or the superphosphate. The latter acts the quicker, but for prolonged returns the coarsely ground bone is best. This must be broken up and well decayed before it becomes available.

The application of nitrogen in a leguminous crop is much cheaper than in nitrate of soda.

(3) *Combinations.* From data gathered this summer, 1910, the following methods of fertilizing are selected:

1.	10 tons farmyard manure @ \$1.50	=	\$15.00	
2.	6 tons farmyard manure @ \$1.50	=	9.00	
	200 lbs. bone meal @ \$1.50 per cwt.	=	3.00	
	100 lbs. muriate @ \$2.15 per cwt.	=	2.15	\$14.15
3.	30 lbs. vetch @ \$6.00 per bus.	=	3.00	
	200 lbs. bone meal @ \$1.50 per cwt.	=	3.00	
	100 lbs. muriate @ \$2.15 per cwt.	=	2.15	\$8.15
4.	20 lbs. red clover @ \$9.00 per bus.	=	\$3.00	
	200 lbs. bone meal @ \$1.50 per cwt.	=	3.00	
	100 lbs. muriate @ \$2.15 per cwt.	=	2.15	\$8.15
5.	1 bus. rye @ 95c. per bus.	=	\$0.95	
	20 lbs. vetch @ \$6.00 per bus.	=	2.00	
	200 lbs. bone meal @ \$1.50 per cwt.	=	3.00	
	100 lbs. muriate @ \$2.15 per cwt.	=	2.15	\$8.10

Any one of the above methods is recommended. Choose the one that suits your conditions best.

(4) *Chemical Analysis.* The following is the analysis of the fruit, wood and leaves from nine-year-old Elberta trees, showing the comparative amounts of the fertilizer constituents removed by the different parts of the tree. Two other varieties, Champion and Hill's Chili, though not grown much with us, are given also. (Geneva Bulletin 265.)

	Total weight.	Water.	Nitrogen.	Phosphorus.	Potash.
Elberta	249.64	201.29	.473	.151	.424
Champion	190.03	150.04	.633	.130	.668
Hill's Chili	251.	203.69	.757	.175	.714

Total weight includes fruit, leaves and new wood, and the results are in pounds.

The total dry matter removed on an average per tree was almost 46 pounds, distributed as follows:

In the pulp	17 lbs. or 38 per cent.
In the stones	6.5 lbs. or 14.5 per cent.
In the leaves	17 lbs. or 35.5 per cent.
In the new wood	5.5 lbs. or 12 per cent.
	45.0 lbs. or 100 per cent.

Each tree removed from the soil .6 lbs. of nitrogen, 19.3 per cent. of which was in the pulp, 4 per cent. in the stones, 67.7 per cent. in the leaves and 9 per cent. in the new wood. Also each tree removed .15 pounds of phosphorus, of which 42 per cent. was in the pulp, 5 per cent. in the stones, 44 per cent. in the leaves, and 9 per cent. in the new wood. In potash each tree removed .6 pound, of which 49 per cent. was in the pulp, 1 per cent. in the stones, 45 per cent. in the leaves and 5 per cent. in the new wood.

Any one of the five methods of fertilizing previously mentioned will replace in the soil the fertilizer removed by the crop.

Thinning. The average orchardist does not really know the meaning of thinning as applied to the production of first-class fruit. To many it is a fancy touch and means labor for which no returns are to be expected. A few recognize the real value of thinning. The general reply of the grower, when asked if he thins his fruit, is: "Yes, with the pruners." This means that an attempt is made while pruning to remove all surplus wood, leaving only enough new wood and buds to produce a moderate quantity of fruit, or just what the tree can grow to good size and ripen nicely. But this manner of thinning is not usually a success, as it tends to leave the fruit in bunches. Most growers have not sufficient moral courage to cut away half of the tree, and when the fruit is left in bunches it cannot be expected to attain as great a size and reach as high a color as when scattered well over the tree.

Hand thinning has been one of the most important factors in the production of high-class fruit in the West. The neglect to thin has been one of the reasons why trees in many sections bear only once in two years, and then flood the market with inferior fruit.

Besides the advantage of producing a higher quality of fruit, thinning has the advantage of preventing the over-working of the tree, so that fruit buds are produced for the following year, preventing damage from breaking down with excessive loads and developing regular bearing habits in the tree.

When to thin is a disputed point, but immediately after the "June drop," when the peaches are about the size of shelled walnuts seems a very satisfactory time. At this time the pits are forming and are just distinguishable from the rest of the peach. Less than a week later the shell has begun to harden.

What to remove is simpler to understand than when to remove it. Any grower knows that double fruits can never make first-class specimens. Shrivelled, stung, wormy, or otherwise defective fruit has no place on the well-cared-for tree. Leave the largest and as close to the main limb as possible, with plenty of leaves between the peach and the end of the branch.

Very few know how to thin. The grower hates to see thousands of good fruits thrown to the ground. He wants all, and in his eagerness is not willing to sacrifice quantity for quality. Most growers leave too much fruit on the tree.

The following is the result of an experiment concluded on fifteen St. John trees in the summer of 1910: The trees were healthy, of average size, nine years of age, and headed and pruned rather high. The previous year they had borne no fruit at all—the first time they had ever failed—and now they were very heavily loaded. These trees were chosen because they gave a chance to observe the greatest extremes. The thinning was done on June 25th and 27th. It required approximately two days to do the work. Distances in thinning can only be guessed at, and a statement of distances must necessarily convey widely different ideas to different persons.

Natural, means that the tree was left with what fruit, in the opinion of the experimenter, it could mature properly.

	Firsts.	Seconds.	Culls.
Unthinned	32½ lbs.	194¼ lbs.	328 lbs.
1 to 3	201½ lbs.	404½ lbs.	62¼ lbs.
3 to 5	245¼ lbs.	295¼ lbs.	9 lbs.
5 to 7	252 lbs.	183½ lbs.	5¼ lbs.
Natural	253¼ lbs.	219½ lbs.	30 lbs.

Unthinned	6,392 peaches, weighing 555.25 lbs., worth	\$7.75
1 to 3	4,503 peaches, weighing 667.75 lbs., worth	22.01
3 to 5	3,466 peaches, weighing 550.25 lbs., worth	20.76
5 to 7	2,595 peaches, weighing 446.25 lbs., worth	17.55
Natural	3,209 peaches, weighing 502.75 lbs., worth	18.73

It will be noticed that the returns from the unthinned trees are very low. This is accounted for by the fact that the trees were extremely heavily loaded. The trees thinned from one to three inches, or just so two ripe peaches would not touch each other, as nearly as could be judged in the early part of the season, gave the highest gross returns. Thinned the greatest distance, or so not more than one peach was left on each twig unless it was exceptionally large, gave the lowest returns. This, however, would not have been the case if the fancy fruits had been graded as such and sold at the fancy price. Also, it was a year in which there was a good demand for almost any grade of fruit. The value is

reckoned at seventy-five cents a basket for firsts and fifty cents for seconds. Some of the best sold for one dollar, but as the exact amount is not known no account is taken of it here.

Rather than thin to a great distance, it is much better to thin to the tree—that is, leave on the tree just what it can ripen nicely. This requires much judgment on the part of the grower. It is very seldom that two trees, even of the same age, are alike in growth and vigor. A tree at the end of the fourth summer should produce a basket of fruit. Some produce more, some less. At the end of the next summer it should produce two baskets; at the end of the next, four; and at the end of the eighth year, ten baskets, or an increase of two baskets a year up to eight years of age. This would be a maximum average, and is given only as a guide, not as an absolute rule, to follow when thinning. Small areas have been known to produce much heavier than this for one season, but the increase cannot be expected to be so great when the trees have once reached maturity. The idea is to remove when small all fruit that the tree is not likely to ripen properly. You know the health and vigor of the tree and how, what and how much you fed it. The tree can draw just a certain amount of food from the soil, and the question is how many fruits is this food to be divided up among. The pits always claim first attention, and it is only after they have been satisfied that the flesh and next year's fruit buds are developed. You have it within your power to say how much shall be left for flesh and buds. Ripen as few pits as possible consistent with quantity.

The Fourteenth Report of the Delaware College, 1902, gives the following percentage composition in the absolutely dry state of Elberta peach.

	Potash.	Phosphorus.	Nitrogen.
Buds	1.67	.85	2.77
Flesh only	2.32	.24	.63
Pit only	1.35	.72	.427

Taking the moisture into consideration, we have the following figures (New York Bulletin 265, Elberta peach):

	Moisture.	Potash.	Phosphorus.	Nitrogen.
Flesh	88.78	.150	.041	.059
Stones	32.67	.067	.081	.254
Leaves	63.78	.305	.141	.779
New wood	44.52	.222	.121	.431

Or, in other words, it takes in round numbers four times as much nitrogen, twice as much phosphorus and half as much potash to make a pound of pits as a pound of flesh. But we need potash for the leaves, which require more than twice as much as the flesh. Therefore, it naturally follows that the more fruits that are on the tree in numbers, the greater will be the nitrogen and phosphorus demand, while if the tree is healthy the leaves, new wood and buds will demand a large quantity of potash. Grow wood, buds, and flesh with as few pits as possible.

PICKING. A peach is ready to pick for the home market as soon as it is springy to the touch. Taken between the thumb and finger and pressed gently, being careful not to bruise, it should give slightly and have a mellow feel. If it dents with this slight pressure, it is over mature and too soft to ship. If it feels hard, more than just firm, it is too green to pick. But the experienced picker goes more by the eye than by the touch. A red cheek with a yellow tinge, from which the green has entirely fled, denotes maturity. It needs no pressure test. Freeing readily from the stem without tearing is a good sign of maturity. All the fruit on a tree cannot be picked at one time. It must be gone over three, four or perhaps five times. The removal of the fruit nearest maturity gives the rest a chance to develop, when the larger and more mature are again removed, and so on until in about a week or ten days the last peach is removed.

The fruit is usually picked directly into eleven quart baskets, such as are used for shipping. These, as they are filled, are placed in the shade of the tree, from whence they are gathered and taken to the packing house. Here the fruit is graded and packed for shipment.

Peaches intended for export must be handled much more carefully, as the slightest bruise will cause decay when held for a long period. They are picked singly and placed directly in the boxes on wood fibre, in which they are carried to the packing house.

More careful handling and packing of the fruit for the home market is recommended.

When picking remember:

- (1) That the fruit must be ready.
- (2) That you are handling peaches not stones.
- (3) That when once the fruit is picked shade is preferred to hot sun.
- (4) That moisture hastens decay.
- (5) That some one is expected to eat every peach put in the basket.

PACKING. Packing at one time was considered of little importance. A basket filled to the top and covered with the ordinary patent cover was the only package the grower knew. But the public demanded something better, and the growers are gradually realizing it.

(1) Patent covers on eleven-quart baskets are still used today for all the poorer grades and for a large part of the better grades also, though for these latter it is gradually being discarded. The bulk of the

fruit, however, is still shipped in them, because the market has learned to know the brand. The West has learned it and now demands it. But each year sees the fruit graded and packed more carefully.

(2) Sometimes another layer of fruit is placed on the top of the above package and all covered with a muslin sewed on to or turned in under the framework of the basket. This makes a quite fancy package and commands a much increased price over the first. The fruit is shown to much better advantage.



The box package is increasing in favor for both local and long distance shipments. No pilfering or bruising of the fruit.

(3) Nine-quart baskets with bottoms the same size as the eleven-quarts, but with sides of just such a height that two layers of first-class fruit come even with the top, are gradually winning a place. This package is used in fancy trade only.

(4) Six quart or grape baskets are also used for fancy fruit and are in great demand among tourists who wish to carry a basket of fruit in the hand.

(5) The box 18.5 x 11 x 4 inches, inside measurements, holding about seventeen pounds, and which displays the fruit to the best advantage, is used for a certain fancy trade also. This is the package that pleases the retailer. The fruit here must be fancy.

(6) The Georgia peach carrier which holds six baskets of about four quarts each is used but little.

(7) A smaller box, 17 x 11.5 x 3.5 inches, holding from 20 to 27 peaches, is used for the British trade only. This is the special package for that trade.

It cannot be said that this great variety of packages has a very distinct advantage. In the opinion of the writer four packages well-known to the trade would be better than seven or eight.

SELLING. The manners of sale are as varied as the packages in which the fruit is packed. In the western sections of the Province nearby cities and towns take a large quantity. The market is right at the door of the producer and hundreds of baskets are sold right at the orchard or delivered by wagon to the nearest town. In the Niagara Peninsula a large quantity is taken by Catharines and Hamilton, but hundreds of cars are shipped east and west.

There are five distinct ways of selling:

- (1) Directly through the commission houses.
- (2) To the buyer.
- (3) To the canning factory
- (4) Through the co-operative associations.
- (5) By private order.

It must not be supposed that each individual grower adheres to one of these methods. The great majority of growers have no special method of sale, the method that appears best after the fruit is picked being often used.

The co-operative associations handled the fruit of more growers in 1910 than ever before. In the same areas the buyer claimed a larger portion. The factory handled the fruit of a less number. Where the co-operative associations are established, the number selling through the commission houses is greatly lessened. In Niagara township where no co-operative association has yet been established (1910), at least 65 per cent. of the growers sell through the commission houses. The factories claim nearly all the rest. No buyer has as yet secured a firm hold there. In Grantham, 55 per cent. sell through the co-operative associations. (The co-operative associations sometimes sell by commission, but that is not considered in the percentage). In Louth the buyers handled fully 50 per cent. of the peaches in 1909. In Clinton they handled 60 per cent. but this latter was cut down considerably in 1910, owing to the work of the Ontario and Western Co-operative Association. A few growers in all sections have a special trade, selling directly to consumer or retailer.

COMMISSION. Under this system the wholesaler keeps the books. Suppose, for instance, six baskets are shipped from Queenston and sell for seventy-five cents each, or \$4.50 in Toronto. The commission man keeps 10 per cent., or forty-five cents, gives the railway thirty cents, and returns the balance, \$3.75, to the grower. Or the grower gives one basket for selling five. Also this method encourages the shipment of inferior goods, which are sold on the general markets and sometimes cause a glut.

It is, however, possible for good growers to build up good markets by commission. This has been done by at least three of the best growers in the Niagara Peninsula, but they sell only through one man, or two at the most. Their supply is large and of excellent quality and consequently has become known to the trade.

The most inexcusable practice is that of dividing up a small load of perhaps not more than fifty baskets between two or three different commission houses. The fruit then must be sold on a general market, which gives the brand no chance of gaining favor. One part of the load is also sold in competition with another part.

BUYER. The buyer has done a great deal to enlarge the peach market. It was his interest to do so. He has placed the fruit on many distant markets which have taken a large quantity from the general trade and tended to keep up the price. He has done a good work and in the majority of, but not all, cases, has been well paid for it. This manner of sale has its defects also, because:

- (1) All are paid the same for what appears to be the same grade of fruit.
- (2) It does not encourage careful grading and packing.
- (3) It does not allow the grower to make a reputation.
- (4) It puts the profits into the pocket of the capitalist, the man who takes the risk.

CANNING FACTORY. Many claim that most money is made by selling directly to the factory. At any rate, there is little expense connected with it and the money is paid in a lump sum. The fruit is piled in baskets or crates, sorted into two grades, canning and pie peaches, and delivered at the factory at prices ranging from 1.5 to 5 cents a pound, depending on the quality and season. The baskets or crates are returned to the factory or grower.

All varieties, except the very early, are in demand, but Hill's Chili, Smock, Crosby and Elberta are favored most. The Smock in particular is an excellent canner, and large areas have been planted to it for this purpose, especially in Niagara township. The factory also takes care of a large quantity of cull fruit, that would otherwise go to waste, for the manufacture of jam.

CO-OPERATIVE ASSOCIATIONS.—The following advantages are claimed for these. They—

- (1) Extend the markets;
- (2) Encourage careful grading and packing;
- (3) Save express and freight charges (car lots);
- (4) Put the small growers on an equal footing with the large,
- (5) Save the capitalist's profits;
- (6) Are educational institutions.

A discussion of the work of the different associations is not necessary here, but the work being done by them indicates quite clearly that where growers in one locality are able to ship car lots at regular intervals it is the best method of selling for the reasons mentioned above

BY PRIVATE ORDER. This is an exceptionally good method of sale and many growers have worked up good trades. The best city customers are anxious to buy this way, and where the growers have the right kind of goods it is exceptionally profitable. Many retail merchants are anxious to buy this way also. This method of sale also encourages careful packing, because a customer if once deceived is not likely to return. The writer this summer saw a shipment from a supposed responsible firm that was not up to the mark, and the retailer remarked to him, "I don't want any more from there." At the same time the demand for quality, packed as it is represented, is increasing.

A comparison of the returns from the different methods of sale is not possible with the data at hand. Each method has its advantages, and one may be better adapted to one section than another; but, generally speaking, the co-operative method is gaining fast, and the commission man and the buyer are losing ground. The factory will always have its place, because it handles large quantities of fruit that would otherwise go to waste. More factories would be a boon to the industry.

MARKETS.—The West, especially Manitoba and Saskatchewan, is the coming market for the surplus of Ontario peaches, under present conditions. At present the cities of our native Province take the largest quantity, but they are not developing or growing so rapidly as the Western cities are, and consequently the home demand is not increasing so rapidly; but the smaller towns and the towns of New Ontario are taking more each year.

The Western market is the field of greatest activity at present. Winnipeg and some other Western cities are familiar with the Ontario packages, and they look for fruit in quantity at a reasonable price. The fancy or box trade is limited and cannot yet consume a very large quantity.

A large undeveloped market is yet to be found in the small towns on the Transcontinental Railways. A large farming population is demanding fruit also, but the distribution is so limited that they seldom see a peach.

Montreal has no trade in fancy Ontario peaches, or at least the box fruit brings no more than the same quantity in baskets.

Toronto is the largest market and the poorest supplied with first-class fruit. It is the dumping ground of the careless grower, and is always well supplied with the poorer grades. Prices are usually low. Very little box fruit, comparatively speaking, is handled in the city. Some prominent growers are sending large quantities of their best fruit in baskets, and are receiving excellent returns, and there is room for more of this to help crowd out the trash.

The newest, and what promises to be an excellent market in the future, is that of Great Britain. Its value to us has not yet been fully demonstrated, but the Dominion and Provincial Departments together with a few growers are experimenting there. The first shipments of

only a few cases were made in 1909. This year, 1910, 7,168 cases or boxes were forwarded under cold storage, and for the most part arrived in excellent condition. They were distributed throughout the leading cities of Britain, and some of the cities of the continent, and in no case was there an unfavorable report of the fruit. Prices per case varied a great deal, depending on their condition and the market, but gave an average return of 80.7 cents f.o.b. Jordan Station. They were sixteen days in transit, and cost 23.3 cents per case to put on the market.

Our fruit is yellow-fleshed mostly. The English market favors a white-fleshed peach, and consequently the white-fleshed peaches forwarded brought the highest prices. This does not mean that the planting of white-fleshed peaches is recommended. At this time it is unsafe to advise. The market is not yet established, and much experimental and educational work must be done before shipments can be taken up by the average grower.

The price, 80.7 cents f.o.b for six pounds of fruit, or about twenty-four peaches, may seem very high, but it really is not so when we consider the extra expense of careful handling, packing, etc., and that only the very highest quality fruit can be used.

The expense of delivery makes the price to the English consumer very high, which means that consumption must be limited. A lower price to the grower and less transportation expense would be more satisfactory to all who have a large quantity to sell.

Mr. Dobson, of Jordan Harbor, shipped sixty Georgia cases to friends in Britain in 1909.

In 1910 the following shipments were made:—

From St Catharines Cold Storage	3,743 cases
By the Dominion Department	1,284 cases
By Mr. Dobson	2,141 cases
Total	7,168 cases

RETURNS AND COST OF PRODUCTION.—Returns from orchards under apparently the same conditions are often very varied. So many factors enter into the case that it is impossible to quote a yield that is applicable to the conditions of all, but maximum and minimum returns, together with the average of a number of orchards, should give a fair idea of the possibilities.

The following are the best returns to hand at present: 1906, 20 acres, \$4,263.53 gross; 1907, \$4,193.93 gross; 1908, 26 acres, \$6,193.87 gross; 1909, \$9,011.06 gross. These trees ranged in age from 3 to 20 years.

In 1909, 475 trees gave 1,960 baskets; in 1910, 2,700 baskets. 76 acres, all ages, gave 28,000 baskets, worth \$8,624, in 1909, and 13,000 baskets, worth \$7,400, in 1910. All baskets, freight and commission are deducted, but not labor.

I do not doubt but that many are receiving better returns, but the above show fairly well what is possible, and are considered by many very exceptional.

In comparison to this we have many orchards that are not yielding a commercial quantity and are a yearly expense to their owners.

In thirty orchards, scattered from Beamsville to Niagara-on-the-Lake, which yielded well in 1908, and from which accurate returns were received in 1909, we have 32,460 trees, yielding 111,712 baskets, which sold for \$50,280.33; or each tree yielded on an average 3.44 baskets, worth 44.92 cents a basket, f.o.b.

The average orchard has about 100 trees per acre, which on this basis would mean a f.o.b. return of \$154.52 an acre.

WINTER KILLING AND WINTER PROTECTION.—Winter killing may take place either in the root, trunk or branches. The killing of the root may be from excessive freezing under wet conditions, or from repeated freezings and thawings during the winter months.

The freezing of the branches is the commonest form of all. This is usually the result of going into winter quarters insufficiently matured or ripened to stand the frost. The freezing of the whole tree above ground is the result of excessively dry conditions usually. Even on the coldest day a certain amount of moisture is being sublimed from twigs. The soil must be sufficiently moist to allow the roots to make up this loss when a warm day comes. A moist soil frozen solidly below the roots has even the same effect. A warm day thaws the sap, but the ground being frozen to a great depth no water can rise and, as a result, the cell walls of the tree collapse.

Because of this winter loss various systems of protection have been advised and some adopted. In the very cold section where the fruit is not grown on a commercial scale, it is common practice to draw the limbs together and cover with straw or corn stalks, or to lay them flat upon the ground and cover similarly. The following methods are advised on a commercial scale:

- (1) By use of windbreaks, etc., hold the snow as much as possible. It is Nature's method of protecting plants.
- (2) Mulch with coarse straw or manure around the base of the tree as soon as the ground is slightly frozen in the fall. This prevents the frost from penetrating any great distance, and also holds the frost and delays growth in the spring.
- (3) Grow a heavy cover-crop. This is the best and cheapest way of obtaining the desired results. Besides acting as a mulch it collects and prevents the leaves from blowing away in the fall, and it draws the surplus moisture from the soil and ripens the wood and buds. It has the advantage of being cheaper than a manure mulch.

INSECTS.

BLACK PEACH APHIS (*Aphis Persicae-niger*) is not common in Ontario. It attacks the roots of the trees, especially when first planted, but a good application of farmyard manure seems to force their recovery or make the tree sufficiently thrifty to outgrow the attacks.

PEACH TREE FRUIT BARK BEETLE (*Phleatribus luminaris*) and FRUIT BARK BEETLE (*Eccoptagaster rugulosus*) are located by green exudations on the trunk and main limbs; cut out and destroy injured parts of trees in winter or early spring; remove all dead and dying trees.

PEACH BORER (*Sannina exitiosa*).—The adult is a clear-winged moth, but the larvæ do a great deal of damage by working under the bark in the sapwood of the trunk near the ground. These may be prevented from entering by wrapping the tree with two or three thicknesses of news paper up to about eighteen inches high, or painting with coal tar to the same height, about mid-summer. This hinders or prevents the egg laying. When once the larvæ have entered the tree they must be removed with a knife by digging them out in the months of October or the following May. It is well to go over the trees twice. Low headed trees are less attacked than high headed. Banking up with earth in mid-summer prevents their working to some extent.

LESSER PEACH BORER (*Aegeria pictipes*) resembles very much the above, only it attacks anywhere on the trunk and large limbs. It must be treated the same as the above when once it has entered the tree. Keep trees in good health.

PLUM CURCULIO (*Conotrachilus nenuphar*) does a great deal of damage by stinging the fruit, and allowing the admission of the Brown Rot spores. Spray with arsenate of lead, two pounds to forty gallons of water, when fruit is about the size of a pea. Repeat sprayings every two or four weeks if necessary, using self-boiled lime sulphur and poison.

PEACH SAW FLY is not known in Ontario, but where common does damage by the larvæ eating the leaves of the tree. Spray with two pounds of arsenate of lead in forty gallons of self-boiled lime sulphur or water as soon as the pest is noticed.

SAN JOSE SCALE is the greatest enemy of the peach, but it requires no description here. When left untreated it makes the fruit unsaleable, and then kills the tree outright.

Control.—Spray thoroughly with winter strength lime sulphur before the buds burst.

DISEASES.

The diseases of the peach are discussed in the second part of this Bulletin, by L. Caesar, Lecturer of Fungus Diseases and Insects at the Ontario Agricultural College, Guelph, as Mr. Caesar has made a special study of these diseases.

SPRAYING.—One spraying only is all that the peach tree receives generally in Ontario. This is given, for best results, as late as possible, before the buds burst or just when they are beginning to swell. Two or three weeks earlier will give almost as good results. Home boiled, commercial, or home-boiled concentrated, lime sulphur is used. This cleans up the tree generally, destroys scale insects, and prevents the developing of Leaf Curl, previously mentioned. Without this spray no success can be looked for in peach culture. The spray should test at least .027, hydrometer reading, .03 is better. If left too late this spraying will not destroy the Leaf Curl. If the tree is infested with San Jose Scale, use the spray as strong as .032 hydrometer test.

The second spraying, if it is required, should be given with summer strength, commercial, or self-boiled lime sulphur, when the fruit is about the size of peas. This controls the rot and mildew to a large extent also. Poison, one pound of lead arsenate to forty gallons of solution, added to this destroys the curculio. Other sprayings may not be necessary, but at the first appearance of the Brown Rot or Mildew, it is well to repeat the spray recommended for the second application, leaving out the poison, that is for the third or fourth spray use self-boiled lime sulphur only.

LAND PRICES.—The price of unplanted peach land has been steadily rising for the last five or six years, till now, in the more favored sections, it has reached a maximum of \$1,000 per acre. But this is abnormal and is more than the intending purchaser can afford to pay if he wishes to reap good interest on his money. In the eastern sections of the Niagara Peninsula, good peach soil may be had for from \$150 to \$300 per acre, but it is unimproved, some distance from the railroad and not in the co-operative districts. About \$250 an acre would be a good, fair price for average peach land in the Niagara Peninsula. An orchard, three or four years of age, of good varieties, in the average locality, is worth about \$600 an acre and will pay expenses and interest on that amount. Many sales are being made away above this figure.

In Lambton, Essex, Elgin, Kent and Norfolk counties, etc., first-class peach land may be had for from \$50 to \$125 an acre. This, from all appearance, is just as good as any in the Niagara Peninsula but has not yet been developed nor thoroughly tested.

POPULATION.—It is very interesting to note that while so many sections of Ontario are decreasing in population the Niagara district has gained very rapidly. The following are the comparative figures for the fruit townships and the general farming townships of Lincoln County:—

Fruit Townships—	1907.	1910.	Gain.
Niagara	1,574	1,674	100
Grantham	1,976	2,198	217
Louth	1,685	1,860	175
Clinton	1,736	2,052	317
North Grimsby	1,365	1,505	140
	8,335	9,284	949
General Farming Townships—			Loss.
South Grimsby	1,287	1,222	65
Gainsborough	2,180	2,064	116
Caistor	1,524	1,379	145
	4,991	4,665	326

The population is decidedly mixed. The new-comers include many Englishmen with capital, city business men, commercial travellers and others who realize that peach land is a good investment. These intermingling with the hard, practical pioneers, make first-class fruit farmers, and at the same time they lend some of their keen business ability to their neighbors, which is a great stimulus to the industry as a whole. Every man who handles fruit is fast becoming a business man, learning how to invest a dollar for the best returns and considering the cost as well as the selling price.

FACTORS OF SUCCESS OR FAILURE.—When a man is once properly located, success or failure in peach production depends more on his own ability than on any other single factor. Some men who were excellent stock and grain farmers have made miserable failures of peaches. The methods applicable to the one are valueless in the other. A man must know his soil and his varieties; he must know how to plant, prune, cultivate, fertilize and spray; and when to pick and how to pack. He must know good methods, good trees and good fruit. He must have high ideals and he must work; and he must have good business ability to fight for his place in the co-operative association or in the commission market.

Neglect to fertilize, cultivate, spray, thin or pick at the proper time means failure. One day late often means dollars of loss. The package and packing also often decide the success or failure of the business. Too great care and too much patience cannot be exercised. Knowledge of the minutest details is absolutely necessary. Where one man succeeds, two men fail, even in the same locality and on the same class of soil. If you do not know your business you will soon be forced out of it.

PEACH DISEASES

L. CAESAR, O. A. C., GUELPH.

In discussing the peach diseases of Ontario, I shall deal only with those that are likely to be familiar to the growers and that are of



Fig. 1. Peach Leaf-curl.

economic importance, omitting a number that are interesting, chiefly or almost solely to the plant pathologist. The following will be considered: Leaf Curl, Brown Rot, Scab or Black Spot, Gum Disease and Cankers, Powdery Mildew, Crown Gall, Yellows and Little Peach.

NOTE.—This was an address delivered before the Fruit Growers' Association of Ontario, November, 1911.

LEAF CURL, *Exoascus deformans*, (Berk) Fuckel,

Every peach grower is familiar with this disease and knows that it attacks the leaves early in spring and causes them at first to become thickened, curled and distorted and of a pale whitish, or often reddish color, and later on to become brown and dead and fall off. It is, next to Yellows and Little Peach, the most destructive disease that growers have to combat. The loss takes the following forms: (1), In seasons of severe attack many young nursery trees are killed the first year they are set out and before they have had a chance to get over the shock of transplanting; (2), There is a great drain on the vitality of older



Fig. 2. Peach tree almost defoliated by the Leaf-curl disease.

from the loss often of a large part of their foliage early in the season, and the necessity of producing a new crop of leaves. Such trees are frequently not properly matured for winter and are sometimes killed by the cold. Trees severely attacked, two or three years in succession, not infrequently die, or at least lose a number of their branches; (3), The fruit is dwarfed and often in bad cases drops off. This is to be expected from the fact that the substances that make the fruit are largely manufactured in the leaves, and that this source of

supply is cut off for a considerable period by the disease; (4), The disease often attacks young shoots or twigs and kills these.

Leaf Curl is well known not to be so severe some years as others. Experience has shown that it is favored by damp, late springs, while it is almost completely kept in check by dry, sunny weather, around the time of blooming, and while the leaves are still quite small. Last year, 1910, the spring was very late, cold and wet, and so the disease was exceptionally severe. This year, 1911, the spring was early and we had beautiful, hot, sunny, dry weather, with the result that there was no Leaf Curl or almost none. This fact has led some to believe that Leaf Curl is not a disease, but is merely the result of unfavorable weather conditions. Such, however, is not the case, as anyone can easily prove who takes a glance through a microscope at one of the dead leaves from an affected tree and sees the millions of spores on the surface. These spores act like seeds, and are carried by the wind from tree to tree and orchard to orchard, but so far as we know do not germinate until the next year. For their germination then, and growth plenty of moisture is necessary, hence the wet seasons favor their development; moreover cold does not interfere with this, while it retards the vigor of the leaves.

A number of years ago we were told that spraying would not control the disease, because it was then believed that it passed the winter only in diseased twigs; but we now know from thousands of experimenters that even in the most favourable seasons for the disease we can keep it under thorough control by a single application.

Means of Control: Spray with lime-sulphur of the ordinary strength as for San José Scale (1 gall. commercial wash, diluted to about 10 with water). This application must be made *early in spring and before the buds have begun to swell*. The disease begins with the growing bud, so to prevent its getting a start we must spray early before the spores around the buds, can germinate. *Most of the failures to control the Leaf Curl are due to spraying too late, and not taking sufficient pains to see that every bud is thoroughly covered.* Bordeaux would also control the disease, but is not recommended, because in most peach districts San José Scale is either present or likely to be introduced, and the lime-sulphur will keep it in check while Bordeaux will not.

BROWN ROT, (*Sclerotinia fructigena*) (Pers.) Schroet.

This is the same disease that is so common on plums and cherries, especially sweet cherries, and that frequently causes a large percentage of these fruits to rot. Fortunately, in our Province, it is not so destructive as a rule to peaches as to cherries and plums, or as it is to peaches

in some parts of the United States, where it has been known to destroy as high as 40 per cent. of the whole crop in a year. Nevertheless, we sometimes lose a good many peaches from this rot. Triumphs and a few other varieties are much more subject to the disease than Elbertas and some of our other profitable kinds.

Not only is the fruit attacked, but also the twigs and small branches on which diseased fruit is borne. The disease in such cases seems usually to work its way down from the diseased fruit into the twig or branch and gradually girdle it. This, of course, causes the part above,



Fig. 3. Brown Rot on Plums (after Duggar).

with all its leaves, to die. Some seasons the blossoms are also attacked. I have noticed this to be quite common in the case of sweet cherries.

Like most diseases there are certain conditions that favour the development of Brown Rot. The chief of these are damp, warm weather, lack of sunlight and of good air circulation, the presence of old mummied fruit on the trees, two or more fruits touching one another on the tree, and injuries from hail or biting insects, like the Plum Curculio.

Means of Control: The above conditions favouring the disease give

us hints as to how we may help to ward it off. (1), Give the trees plenty of sunlight and good air circulation by removing unnecessary windbreaks and by judicious pruning; (2), Knock all old mummied peaches and plums off the trees in the fall, and either gather and burn them or plow them under early in spring; (3), Thin the peaches so that no two will be touching one another; (4), Spray with lime-sulphur for Leaf Curl, and this will protect the blossoms from attack; (5), If the Curculio is troublesome, spray with 2 or 3 lbs. of Arsenate of Lead to 40 gallons of water soon after the fruit is set, and remove all rubbish and thickets from around the place corners, as the beetles winter in such rubbish. (Two or three pounds of freshly slaked lime may be added to each barrel of the spray mixture as a safeguard against burning); (6), Spray with self-boiled lime sulphur about a month or five



Fig. 4. Peach Scab. Note the small blackish spots and the cracks in the fruit.

weeks before the fruit is ripe. Bordeaux or commercial lime-sulphur is likely to injure the foliage. (For directions for making the self-boiled lime-sulphur see Spray Calendar or lime-sulphur bulletin.)

PEACH SCAB OR BLACK SPOT (*Cladosporium carpophilum*, Thum).

This disease causes small, blackish spots here and there over the surface of the fruit. Sometimes these are very abundant and disfigure the fruit greatly; occasionally a fruit is so badly attacked that it cracks open in the same way as a Flemish Beauty pear does when attacked by Pear Scab. As a rule this is not a very destructive disease in Ontario.

Means of Control: Spraying with the self-boiled lime-sulphur about a month after the fruit is set will usually control this disease quite satisfactorily, as shown by the experiments of Professor Scott, of Washington, D.C.

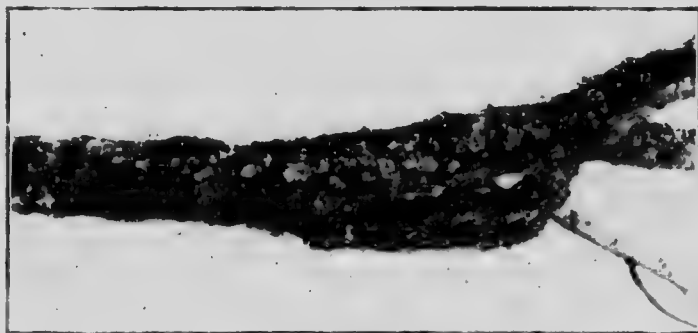


Fig. 6. Peach tree badly attacked by gum disease (original).

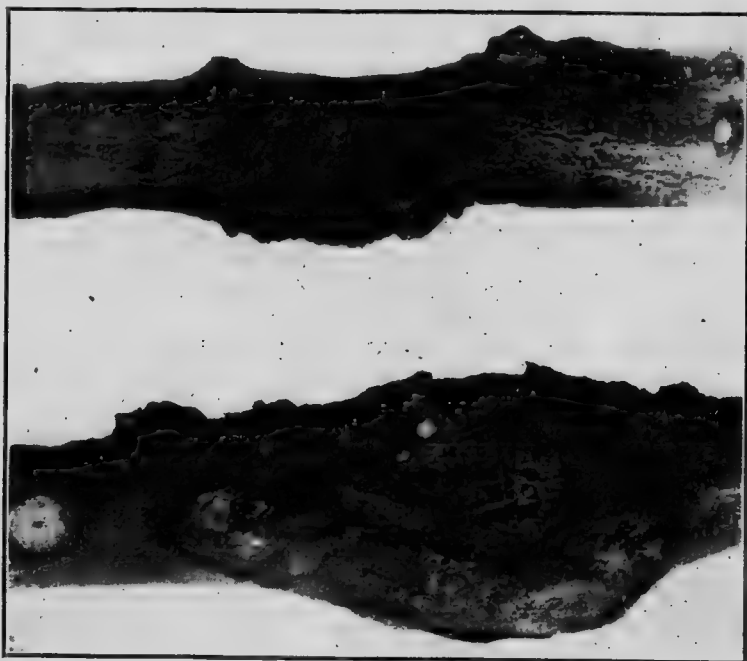


Fig. 5. Small cankers on peach branches, natural size (original).

CANKERS AND GUMMING OF PEACH TREES.

In certain localities in the Niagara district, especially at Queenston, Niagara-on-the-Lake, St. Catharines, and in one or two orchards at Winona it is a common thing to find large, black, gum-covered cankers,

chiefly on the upper side of large branches. These cankers do not heal over, but continue to widen out and enlarge until finally the whole branch dies. The disease is not confined to Ontario, but is quite common in Michigan and in parts of New York State, and probably in other states as well.

In Ontario, so far as I know, it was not very troublesome until the spring of 1908, and in that and the next year there was a regular epidemic of it in the above mentioned districts. Since then there seems to have been much fewer new cases, but the old ones are still active, and are causing the loss of many branches in otherwise vigorous orchards. The cause of these gummy areas is very doubtful. There is apparently no bacteria present. At first, as the result of a number of inoculations, it was shown that the Brown Rot fungus would, if inserted through the bark, produce very similar gum masses. I was inclined to think that it must be the cause of the disease, but further study and failure to get any fungus whatever in the wood beneath fresh gum masses, has made me believe that while Brown Rot may have something to do with preventing the healing of some of these cankers, it does not account for the origin of all of them. There is also the difficulty of explaining why some orchards, such as those at Grimsby, should be almost totally free from the disease, though Brown Rot is frequently quite as destructive, or even more so there, than in the diseased orchards. It is also hard to explain, why in many orchards, without any change in methods of spraying there have been almost no new cases. A good instance of this is the large orchard of A. Onslow, near Niagara-on-the-Lake. It is quite possible that very unfavourable and abnormal weather conditions, interfering with the cells of the plants performing their proper function may be the real cause. Much gumming of trees is, of course, frequently caused by small black beetles, known as Shot-hole Borers, but it is easy to determine whether these are the offenders by removing the gum masses and seeing whether there is a small hole through the bark, made by the beetles. Sometimes the fungus *Valsa leucostoma* will produce gumming, but, so far as I can see it seems usually to be a secondary cause, and to enter at some dead area, and gradually kill the living tissues around this

Means of Control: With our present lack of knowledge as to the cause of the gumming of peach trees, it is difficult to recommend any rational method of treatment. It would be wise, however, where a canker threatens to destroy a large and valuable limb to cut out all the dead tissues up to the perfectly healthy bark, disinfect the wound with formalin, 1 part, diluted to about 5 with water, or with corrosive sublimate, 1 part to 1,000 parts of water (this is a deadly poison), and

cover it over well with white lead paint, free from turpentine. A second painting later in the season will usually be necessary.

POWDERY MILDEW (*Sphaerotheca pannosa*, Wallr. Lev.)

This disease is found chiefly on young trees, not yet in bearing, but occasionally it occurs on older trees. It attacks the leaves chiefly, especially those on the terminal twigs, and causes these to become somewhat folded, dwarfed, distorted, sickly, and covered with a powdery, white substance. The succulent twigs on which the affected leaves are



Fig. 7. Powdery Mildew on young peach twigs in nursery (after Duggar). Note the distorted slender leaves almost white with the fungus spore masses.

borne are also attacked. The disease is easily recognized by the white, powdery covering found in abundance on the affected leaves and shoots. This substance consists of countless masses of tiny spores.

This mildew is favoured by warm, moist condition and is worst in late summer and autumn.

It seldom does much harm, though young trees severely attacked are weakened greatly and stunted, and are liable to be winter-killed. This is the same disease that attacks the rose bushes, on which, in fact, it is much more common and destructive than on the peach.

Means of Control: Spraying with the self-boiled lime-sulphur should be an excellent remedy. The spraying should be done as soon as the disease is noticed and repeated about every ten or twelve days. Dusting sulphur over the trees will also control it as has frequently been proven in the case of rose bushes.

CROWN GALL, (*Bacterium tumefaciens*, Smith).

This disease has been shown by Dr. Smith to be caused by bacteria. It attacks numerous other trees and plants besides peach trees, and is



Fig. 8. Large Knot or Crown Gall on main root of 1-year tree (after Phillips).

easily identified by the woody knot-like growths it causes on the trunk and roots. Usually these swellings, when on the trunk, are just below or at the ground. In size the galls vary greatly, some being as large as a fair sized apple, while others may be less than half an inch in diameter. Just how much damage the disease does to a tree is a disputed question, but there seems little doubt that in some cases at least, it either kills it

or greatly stunts its growth. Many trees, however, seem to thrive just as well as if they were not attacked.

Means of Control: I should not myself, plant any tree that had a gall anywhere on it, but would reject it and notify the nurseryman of the fact, requesting him to furnish a sound tree in its place. This seems



Fig. 9. Small galls due to the same disease on the smaller roots of 1-year peach trees (after Phillips).

to be the only safe way to avoid possible danger. It is much better than attempting to cure the tree by cutting off the galls, as in many cases they grow again. Peach trees should not be planted where raspberries have grown, as raspberries are very subject to this disease.

PEACH YELLOWS AND LITTLE PEACH.

As these two diseases are apparently very similar in their nature, and as the only known means of control are the same for both, it seems desirable to discuss them together, instead of taking each separately.

SYMPTOMS OF YELLOWS.—1. The fruit ripens prematurely, being from a few days to several weeks earlier than healthy peaches of the same variety. This premature fruit is usually highly colored and blotched with red on the outside, and on the inside is more or less streaked with red from the skin to the pit; the flesh around the pit is also much redder

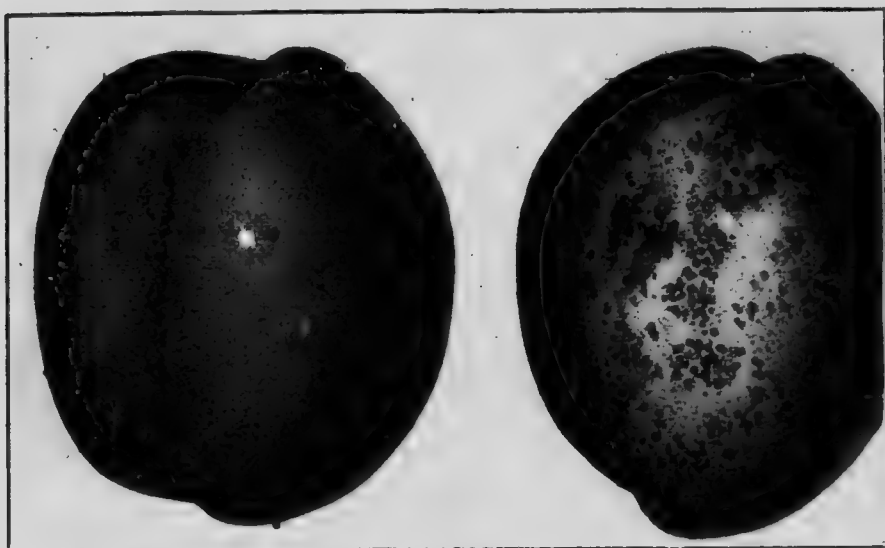


Fig. 10. Premature and healthy peaches from a tree attacked by Yellows (after Smith).

than normal. The flavor with a few exceptions is very poor, being usually insipid and sometimes bitter. Hence, if many such peaches with their fine red colour, but very poor flavour were put on the market they would soon lessen the demand, even for good peaches, because the consuming public would not be able to distinguish between a diseased and healthy peach. The first year the diseased fruit is usually larger than normal, but the second year it is smaller and the next smaller still. Not infrequently diseased peaches are very irregular or knobby on the surface.

2. On trees in which the disease is well advanced, dormant or concealed buds on the main branches very commonly burst

and form little slender shoots with small, narrow, pointed, sickly, yellowish leaves. Sometimes these shoots branch repeatedly as shown in figures 11 and 12. This is one of the easiest means of identifying the disease, but it is by no means always present. In addition to the burst-

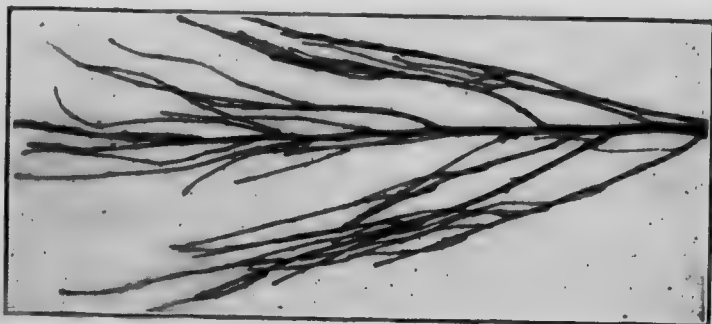


Fig. 11. Bushy, slender growth from main branch of Yellow Pine tree (original).



Fig. 12. Similar bushy growth with narrow pointed leaves from main branch of Yellow Pine tree (After Smith).

ing of these dormant or concealed buds we commonly find that the buds in the axils of the leaves that should remain dormant until the next spring burst the same year as they are formed.

3. When a tree is badly attacked we very often find the leaves turning yellow and becoming curled and clustered in the same way as in the case of Little Peach. In early stages, however, the foliage of the whole tree is usually quite green, and it is only by observing the premature



Fig. 14. Young tree diseased with Yellows; set six months. (After Smith).



Fig. 13. Healthy young tree; set five months. (After Smith).

highly colored fruit on it that we can tell that the tree is diseased. Sometimes only one branch or even one twig will bear such fruit, while that on all the other branches and twigs will be quite normal. Next year more fruit will show the symptoms and the foliage will begin to

grow yellow on at least part of the tree. The disease will sometimes kill a tree in two or three years, but usually it will linger on for four or five years. After the first season the crop is almost always poor and worth less, so that the sooner one gets rid of the tree the better even from a financial standpoint.

SYMPTOMS OF LITTLE PEACH.

Unlike the Yellows, the fruit ripens later than normal, and is usually somewhat smaller, as the name suggests. These symptoms, however, should



Fig. 15. Peach Yellows—result of budding from diseased tree. (After Smith). Bud was inserted at "a" in each case 15 months before photo was made. Diseased growth was headed back on 1 and 3. No. 2 is dead; b, b, b, are diseased growths from stock itself.

not be relied on too much, because we have very frequently in almost every diseased orchard found affected trees on which the fruit ripened about the usual time and was almost as large as the healthy fruit. The second year the fruit tends to be much smaller and probably is more uniformly late in ripening.



Fig. 16. A healthy branch. (After Smith).



Fig. 17. Branch of Little Peach tree just beginning to show the clustering and curling of leaves near the base. (Original).



Fig. 18. Branch of Little Peach Tree, showing badly curled and clustered leaves. (Original.)

Again, in contrast with Yellows there is none of the high coloring and blotching of the fruit on the outside nor of the red streaking inside. As a rule both the outside and inside have the normal color. The flavor, however, is usually insipid, just as in the case of Yellows, though apparently there are more exceptions where the flavour is good or fairly good. Still no one would care to purchase such peaches if he knew they were diseased.

2. The most characteristic and reliable symptom of the disease is the peculiar way in which the leaves curl and cluster, and turn an un-



Fig. 19. Leaves from Little Peach Tree showing characteristic flattening and curling. (Original.)

healthy, yellowish or often reddish yellow color. Most of these curled leaves look to be somewhat shorter and flatter than usual, and by the bending of the midrib they curl down at the tip in a claw-like manner. This curling downward and inwards towards the twig helps to give them their characteristic clustered appearance. On some varieties these characteristics are much more conspicuous than on others, and in studying the disease one should first compare the foliage of various kinds of healthy trees and see how they differ. He will observe that the leaves

on the Crawford and closely allied kinds, like Fitzgerald, are quite different in form from those of Smock, Longhurst, Lemon Free and several similar kinds, and again that Elberta is different from either of the above classes. St. John is a variety that frequently is inclined to have a yellow tint to the foliage that at first is somewhat misleading.

After studying the healthy foliage of these trees examine carefully the foliage of clearly and badly diseased trees of each kind, looking for the symptoms mentioned above. This will give one a picture in the mind to go by, and, having once got it there, is not a great deal of difficulty in passing on to the identification of the disease in its earlier stages. Attention should perhaps be called to the tendency of diseased Elberta leaves to droop as if the water supply had been cut off, but close examination will usually show, even here the characteristic curling and clustering and sickly color on at least some of the central twigs or shoots. Fortunately the disease can easily be identified in young trees from two to five or six year of age, if they are grown in well cultivated soil. In such cases it nearly always shows up in the centre or inner part of the tree, where the leaves turn yellowish or reddish yellow, curl and cluster, while those on the outer and upper parts are still quite green and normal in appearance. One can frequently recognize the disease in such trees fifty yards or more away. Sometimes one sees young trees with all the outer or terminal foliage reddish and sickly, but the central or inner foliage green, vigorous and normal. Such trees are not attacked by Little Peach or Yellows, but usually are somewhat lacking in vigor and often show little brown spots on the leaves, due to what is called the Shot-hole fungus, a disease which helps to produce the unhealthy appearance. Trees in sod and those attacked by San José Scale usually have a sickly appearance and for a little while at first it is difficult to identify the disease on such trees.

3. Sometimes late in the season we find that, as in the case of Yellows, numerous buds have burst in the axils of the leaves and dormant buds on the main branches have pushed forth and produced small shoots. Unlike the Yellows, these shoots never develop into slender bushy twigs with narrow pointed yellowish leaves.

VARIETIES OF PEACHES ATTACKED BY YELLOWS AND LITTLE PEACH.— So far as my own observations go, and as I can discover from reading the literature on the subject, or from questioning growers, there is no known variety of peach that is exempt from either disease. Many claim that naturals are not attacked, but Erwin Smith states that they seem to be just as subject as the commercial varieties. It is often stated that Triumphs are more attacked by Yellows than any other variety, but I think this is very doubtful.

OTHER KINDS OF TREES ATTACKED.—Both Yellows and Little Peach will attack Apricots and Japanese plums, and possibly in rare cases European plums also. This, last August, I was taken by one of the inspectors to see a European plum, that both in the foliage and fruit showed very strong symptoms of the disease. This is the only case I have seen myself, but inspectors Kelson and Hunter of Grimsby stated that they had seen four European plums that they felt certain were diseased. It is quite possible, of course, that something else may account for these cases, but one is strongly inclined to believe that they are exceptions to the general rule that European plums are immune.

Apricots are very little grown, but Japanese plums are very common in most districts and are apparently almost, if not, altogether, as subject to Little Peach as are peaches.

I have during the summer seen at least two small Japanese plum orchards completely destroyed by this disease and several others rather badly attacked. The symptoms of the Little Peach are not so clear on these trees as on peach trees, and often the first thing noticeable is the small size of the fruit. Frequently it is not more than half an inch in diameter on badly diseased trees. The leaves often cluster somewhat as on peach trees, and begin to get a sickly, reddish color and become quite dwarfed. I have only seen a few cases of Yellows on Japanese plums and on these the symptoms were much the same as those given above for Yellows on the peach. In the inspection for Yellows and Little Peach we have up to the present devoted less attention to Japanese plums than we should. They are certainly a source of danger to neighboring peach trees.

HOW LONG THE DISEASE HAS BEEN IN UNITED STATES AND CANADA.—Dr. Erwin Smith, of Washington, has very carefully traced back the history of Peach Yellows, and states that it undoubtedly appeared in the vicinity of Philadelphia as early as 1791, that is 120 years ago. It gradually extended in all directions, but more quickly north-east, north and north-west than south. It has been in parts of New York State for nearly 100 years, in Michigan for about 45 years, and was reported at St. Catharines and Grimsby in 1875 or 1876, about 35 years ago. So that Yellows is by no means a recent disease even in Ontario.

There is not much literature that I could find on Little Peach, but the earliest records I know of would indicate that it has been present in Michigan for about 25 years, and in New York State for over ten years. It has been known in Ontario only for about six years, but has probably been present for about ten years in a few districts. It is only in the last two years that it has become known to many of the growers

as a distinct disease, and of course, the majority do not even know it except by repute.

PRESENT DISTRIBUTION OF YELLOWS AND LITTLE PEACH.—Yellows is found to-day in every state north of Alabama. Large parts of Virginia, Carolina, and Tennessee, and almost, if not quite all of Georgia are free from the disease, but it is quite common in all the states, north of this, and west almost to the Mississippi. It does not occur in Alabama, Texas, Colorado, Utah, or any state west of the Rockies. Apparently it cannot exist under any conditions in Alabama, Texas or any of the warmer parts of the southern states. Prof. Waite tells me there is a line in the south, beyond which Yellows will not develop. The United States and Canada are the only known countries where Yellows is found.

I have not been able to discover just how far Little Peach has spread, but have learned from correspondence with investigators that it occurs in at least Virginia, New Jersey, New York and Michigan, as well as in Ontario, and is probably found in most of the other states also, in which Yellows have been mentioned as occurring. Prof. Waite assures me that he thinks that Little Peach will not exist farther south than Yellows. As to whether it occurs in Europe, Asia or other countries I have no information. In Ontario I believe it is at present limited to the Niagara district, though it may possibly be in some of the other districts.

DESTRUCTIVENESS OF YELLOWS AND LITTLE PEACH.—Any one who thinks that Peach Yellows is not a very destructive disease should read Dr. Smith's voluminous report on it. Time after time he tells of whole orchards being destroyed and sometimes almost all the peach trees in a large district. In several places the disease caused the price of land to decrease by one-half. Several of those present have seen orchards in the Niagara district destroyed by this disease. In October I was over in New York State, and saw there an orchard of about three acres in which there was scarcely a tree that was not attacked by Yellows. The orchard was an isolated one, and was nearly dead with the disease, though apparently not more than ten years of age. It is quite certain that Yellows is, and has been for years a very serious disease wherever it has been neglected.

When we come to Little Peach we find considerable difference of opinion as to its destructiveness. Peach growers and inspectors in Michigan told me that they consider it at least five times as destructive as Yellows. On the other hand some inspectors in New York State claim that it is not doing more than probably one-quarter as much damage there as Yellows. Mr. R. D. Van Buren, Assistant Chief of

Bureau of Horticulture and Nursery Inspection, informs me that he does not consider the disease any more serious or difficult to control than Yellows. My own observations in Michigan last fall and throughout the whole Niagara district this year, would make me think that if Little Peach is as serious a disease elsewhere as it is in Ontario and parts of Michigan, it is at least several times more destructive than Yellows. However, after we have once got it under control I am hopeful that we may find it not any more difficult to keep it so than Yellows. It may be that the present outbreak is more due to the failure in the past to remove diseased trees than to the virulence of the disease itself. I think I am safe in saying that at present nine out of every ten diseased trees show the symptoms of Little Peach, rather than of Yellows. I know of at least seven orchards that are almost totally destroyed by it, and several others in which over thirty per cent. of the trees are attacked. These trees vary in age from three to fourteen years. Some of these orchards contain over 1,000 trees.

My estimate of the total number of trees that showed symptoms of Yellows or Little Peach this year in the Niagara district, and that ought to be removed is over 50,000. We have, I think, about 1,200,000 peach trees in the whole district, so that this gives a little over four per cent. of diseased trees. Probably nine-tenths of these diseased trees will be found in about thirty-five orchards. These orchards are not all by any means confined to any one district, but are pretty well distributed, though three or four or more of the worst diseased orchards are usually found pretty close together.

CAUSES.—The cause of either disease is as yet unknown, having baffled some of the cleverest students of plant diseases of the age. At present a very clever botanist is working on the subject and thinks, I am told, that he has perhaps a clue. The discovery of the cause will be a great boon to all peach growers and will, I think, help greatly to simplify the matter of control.

The claim that the disease is due to our climate being too cold for normal conditions, for the peach seems not to have any force; for it thrives and is never attacked, at any rate by Yellows (we have no data on Little Peach), in China in regions quite as cold as, or colder than in Delaware or Maryland, where the disease is as severe as here in Ontario. Moreover, there are small orchards of old peach trees, over 27 years of age near Collingwood to-day that have no sign of Yellows, and before Yellows came into Maryland, Delaware, New Jersey, Michigan and many other states, whole orchards lived until they were 25 years old and upwards. The fact that the disease will not develop south of a certain parallel of latitude is no proof that climate is the cause, for the peach

itself, does not thrive so well there as farther north. We might as well say, that climate was the cause of Black Rot of the Grape, because this disease thrives in New York State and is never, or almost never found in California; climate is apparently merely a favouring factor.

Again, it seems absurd to claim that lack of proper cultivation of the soil or absence of any of the necessary kinds of plant food is the cause; for we find the disease in sandy soil and in clay, in rich soil and in poor, in well cultivated land and in sod. Moreover Dr. Smith treated 111 plots with various substances, such as potash, sodium, magnesium, iron, sulphur, phosphoric acid, nitrogen, lime, etc. Some of these plots contained only diseased trees, and the object was to see if these could be cured, 645 diseased trees being treated. The rest of the plots contained in all 3,800 healthy trees, and the object here, was to ward off the disease. The result was that none of the 645 trees recovered, and 2,638 trees out of the 3,800 healthy ones contracted the disease from neighboring unhealthy trees. Hence none of these substances, though applied in a most intelligent manner, and in various forms and combinations, was of the least use.

There are many other theories as to the cause, but none of them seem to stand the test.

HOW THE DISEASES ARE SPREAD.—Unfortunately lack of knowledge of the causes of the diseases has made it extremely difficult to determine just in how many ways, or when either of them is spread. We do know, however, by numerous tests made by Smith and Waite of Washington, Welch of Michigan, and Phillips of Virginia, that they can be distributed by taking buds from diseased trees and using these in the nursery to bud seedlings. See figure 15. In almost every case such buds, whether from the clearly diseased or the quite healthy looking part of an affected tree, produced the disease, though in the former case the symptoms appeared more quickly than in the latter. Out of 202 trees budded, from a badly diseased tree by Smith in August, 1887, all had become diseased and were dead in 1891, except three, and these were diseased. None of these trees showed the disease in less than nine months. Again, out of 210 trees budded from healthy looking shoots on a tree just getting the disease, 103 were diseased by the end of 23 months, and next year all showed symptoms. Sixteen of these did not show the disease until two years or more after budding.

Smith's experiments were with Yellows, but Waite and Welch have shown that Little Peach can also in the same way be spread by budding. Welch told me he had budded more than 200 trees with buds from Little Peach, and in every case the disease had shown up, but not until the second year after the budding. There seems, therefore, to be not

the slightest doubt that budding in the nursery from diseased trees is one method of spreading the disease.

In reply to my question as to *how long it takes after a tree contracts the disease until we can see the symptoms of it*. Waite says: * "A bud inserted in August may develop the leaf symptoms the next August, either in a nursery tree or when top-worked into a bearing tree, when it has grown into a branch. In nursery trees or in strong, young trees the symptoms may be so obscure as to be scarcely noticeable. . . . In older bearing trees the curling of the leaves is usually pretty pronounced by September. On some strong growing trees on rich soil at Washington, buds of some Little Peach and Yellows top-worked on some two-year trees scarcely showed the symptoms the first year after budding. The second year they showed up fairly well but were still vigorous and not conspicuous. In the third year the cases were well marked. Ordinarily, I think, however, that bearing trees show their symptoms the year after they are inoculated, though perhaps it may be obscure; and the second year after inoculation, I think, the symptoms come out strongly."

Many think that another method of spreading is that pits from diseased trees are often planted and grow, and such nursery trees develop the disease after they have been set out in the orchard. I have endeavored to get what information I could on this point.

Dr. Smith says that he has got an average of 1 pit out of 1,000 to grow, where he supervised the planting himself. Of 3,104 pits that he gathered from diseased trees and sent to different parties in various states to test, only 15 grew, or less than 5 out of 1,000.

Prof. Waite says he has never been able to get pits from either Little Peach or Yellows to grow. Philips of Virginia, got a small percentage to do so. All of these produced diseased trees by the end of three years. Prof. Blake, of New Jersey, says that nearly all the pits he tested failed to germinate, but one or two did so. These experiments tend to prove pretty thoroughly that pits from clearly diseased trees nearly always fail to grow.

If one will break the pits and examine the kernels of such fruits he will usually find them small and shrivelled, as shown in figure 20. One would not expect such kernels to grow.

We have this year gathered something over 1,000 pits from trees that were just beginning to show the disease and are testing them for germination.

In spite of this great mortality of pits, most of the men mentioned above, state that they are not at all sure that pits from trees that are

*Letter of August 14, 1911.

just taking the disease, but do not yet show the symptoms, would not grow and produce diseased trees. This does not seem to have been tested, and is naturally a hard thing to test, but I believe we can do so another season.

Whether the disease can be propagated from diseased pits or not, there seems to be not the least doubt that it is in some mysterious way spread through the orchard by allowing diseased trees to remain in it. There are many clear cases of this, both with Little Peach and Yellows, and all our experienced growers are satisfied it is a fact. In our inspection work this year, this was brought home very clearly to us in every district. In New York State, as I went around and saw where trees were pulled out for Yellows, and as I talked with growers, I was



Fig. 20. Pits on right from diseased tree; on left from healthy trees. Note that diseased pits are much smaller and shrivelled. The pit at the lower right hand corner of each is on its edge and shows the difference in thickness between them. (Original).

still more convinced of the truth of this belief. It is my opinion that fully nine-tenths of all the diseased trees we saw this year contracted the disease, not in the nursery, but from diseased trees in the orchard itself, or nearby, which had been allowed to remain there, in some cases for two or three years after they had become affected. This is, I think, the view pretty generally held by students of these diseases.

If this view be right the nurseryman is not so much to blame as many fear. Nevertheless, there seems to be no question that our nurserymen cannot possibly be too careful to keep their peach and Japanese plum

stock absolutely free from contagion; for it is clear that if buds should be taken from apparently healthy tree in an orchard, where either disease is present, the tree from which they were taken might have had the disease, but not yet have shown any symptoms of it. I have been told by a good authority of a case that happened some time ago, where buds were in some such way as this, obtained from diseased trees and the nursery stock, when set out, in the orchard, developed the disease. The nurseryman budded another series of seedlings from these young trees in the same way and those in turn developed the disease. He finally found out his mistake and destroyed all the infested stock. Nearly all the nurserymen of New York State and of Ontario get their pits from Tennessee, Alabama and North Carolina, where the bulk of the so-called natural fruit pits are grown. If there is any danger of the disease coming through the pit, a supposition that scarcely seems proven, then there is some risk in using these pits; for in the higher regions of both Tennessee and North Carolina, Yellows is to be found to-day. I do not know whether Little Peach is there yet. I doubt, however, whether any better pits than these can be got, unless from South Georgia, Alabama, Texas, or California, or some such states as these, but in this case most of the pits, I think, would have to be from commercial varieties: These pits are much larger and more costly per thousand. Furthermore there would have to be a guarantee that the pits were not fraudently shipped in from some cannery in a diseased area. It is probable that this sort of thing happens frequently when there is a shortage.

Where diseased trees come from the nursery it is often possible that the source was not the buds or pits, but the presence of older diseased trees nearby. In the past there have been several cases where badly diseased trees have been allowed to remain near nursery stock. This, I think, should be carefully guarded against, and nurserymen should demand the prompt destruction of such trees, and frequent thorough inspection of all neighboring orchards.

WHEN THE DISEASE SPREADS IN THE ORCHARD.—This is a very important point, and one that deserves a great deal of study. At present no one seems to be at all sure about it. Many think that it is at blooming time and that possibly bees carry it; others think that it is spread by pruning; others believe that in digging out root borers at various times in the year we may get our knife contaminated and give the disease to perfectly healthy trees. The fact that it can be inoculated into a tree by budding, makes these last two theories worth careful study. It seems hardly probable that bees carry the disease, or otherwise no tree

would be likely to escape. These are all matters that apparently can be determined pretty fully by careful experiments.

CAN YOUNG TREES BE PLANTED IN THE GROUND WHERE OLD DISEASED TREES WERE DUG OUT?—There seems to be no doubt that it is safe to do this, both in the case of Yellows and Little Peach, but in old orchards it is not desirable as a rule.

MEANS OF CONTROL.—1. The nurserymen should use the greatest care in the selection of buds. I am aware that most nurserymen take their buds from the nursery stock itself, but from time to time most, or all of them get a number of buds from bearing trees. In so doing great care is necessary. Again, it is very important if they are to take the buds from their own stock that they take every precaution against allowing diseased trees to be left in the neighborhood, lest young trees become diseased from these. There has not been sufficient care taken in this matter in the past. It would be an excellent thing if our nurseries could be a mile or two away from all bearing trees, but this hardly seems possible.

What has been said of peaches applies equally to Japanese plums.

2. Every orchard should be carefully inspected in August, and again in September and, until we know more about the time when the disease spreads, the marked trees should be taken out as soon as possible in each case. This is the practice of the men who are keeping their orchards healthy in spite of these diseases. This thorough double inspection each year would also be a means of detecting any diseased tree that might come from the nursery and of getting rid of it before any damage was done. Owners would act wisely in taking out suspicious trees as well as those clearly diseased.

The experience of Prof. Waite in his carefully conducted experiments in Michigan and New York, furnishes strong evidence that the careful inspection of orchards by competent men from about August 1st to October 1st, and the prompt removal and destruction of all diseased trees will rapidly bring either Little Peach or Yellows under thorough control. In addition to this, we have the experience of many good growers themselves, who have practised this method for years and are losing very few trees. But where orchards are close together, co-operation in the work is absolutely necessary, because the disease will spread from one orchard to another nearby and the negligence of the indifferent man may defeat the efforts of the careful one.

SUGGESTIONS.—1. A good biologist should be appointed to spend his summer studying the diseases, helping inspectors to recognize the earliest symptoms of them, encouraging them in their work and holding

orchard demonstrations in each district, so that every grower might have a chance, not only to learn the symptoms, but also to discover the most up-to-date knowledge on the subject. This would be true education. Such an expert could spend his winters in institute work or might be added to the Biological staff of the Agricultural College.

2. There should be an almost entire remodelling of the present system of appointing, paying and overseeing inspectors. The need of this will be very clear when the following points are mentioned:

(a) There is no method to-day of training an inspector for his work or of seeing that he is efficient in it. As it is, any man may be appointed, even if he has never seen either disease. Such a man may make an excellent inspector, but, if so, no thanks are due to those who appointed him and for some time at least he is greatly hampered by his lack of experience, and is very likely at the outset to lose the confidence of the growers who may fear that he is marking trees that are not diseased or is overlooking many trees that are affected. Mistakes of this kind are costly and should not be necessary.

(b) Under our present system there is no means of seeing that an inspector will do his work loyally. He may inspect all the orchards in a haphazard way, or he may only work a few days here and there when it suits him and let the greater part of the orchards go. Again, he may inspect the orchards carefully and mark all trees, but to avoid making ill-feeling, may not take any steps to see that the trees are taken out if the owner does not wish to do so.

(c) The present rate of wages are not sufficient to keep the best men, as a rule, at the work and to induce them to do their best, especially as in many cases inspection is a thankless task. I never recognized until this season how trying a thing this work is, and how hard it is to go into a fine orchard and mark tree after tree, especially when the owner is very doubtful whether they are diseased or is openly hostile to their being marked.

(d) The township council may hamper the inspector greatly by urging him to hurry the work over, and thus keep down expenses or by advising him not to insist on marking trees or requiring their removal when the owners object strongly, especially if these owners have considerable public influence.

From these things, therefore, it is surely quite clear that our present system is not at all business-like, satisfactory or a credit to the province. I shall not attempt to outline fully a new system, but would propose the following:—

(1) The inspectors should be appointed by and be responsible to the Provincial Government, and should report bi-weekly the number of

trees inspected, the number marked and any other matters likely to be of special interest. These reports could, if so desired, be sent to the expert biologist, and at the end of the season could be worked up by him, and form part of his report on the work done on the diseases during the season.

(2) The salary should be increased so that a man begins on say, \$3.00 per day of ten hours, with travelling expenses when his work takes him away from home, and at the end of the first month, if his work is satisfactory, should receive at least \$4.00 per day for the rest of the season.

Part of the money necessary to pay these salaries and those of the biologist could be assessed on the townships interested and part paid by the Government.

(3) Inexperienced men should be assigned as companions to experienced men, until they have thoroughly learned the symptoms of the diseases and the methods of work.

(4) Whenever the expert reports favorably on the work of an inspector, he should be re-appointed year after year at the maximum salary.

In conclusion, I should say that in spite of the system the great majority of the inspectors are doing very loyal work, and are showing an excellent public spirit in their efforts, often in the face of much opposition, to stamp out these diseases. I believe that nearly all of them know the symptoms of the diseases well, and so far I have seen no mistakes have been made by any in marking trees. They are all, however, very anxious to see the present methods changed for a more permanent and business-like one.
